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## A BASELINE HISTORICAL ANALYSIS OF NECK AND BACK-RELATED MORBIDITY IN THE U.S. ARMY: OCCUPATIONAL RISKS POTENTIALLY RELATED TO HEAD-SUPPORTED MASS

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U.S. ARMY MEDICAL RESEARCH AND MATERIEL COMMAND

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This study documents the morbidity of neck and back injuries among U.S. Army Soldiers, focusing on populations at greatest potential risk (e.g., pilots, parachutists). We hypothesize that individuals in occupations requiring the use of equipment that places a heavy load on the head will be at greater risk for acute and chronic neck and back injuries and musculoskeletal conditions. Analyses include calculation of frequencies and unadjusted rates of each health outcome (hospitalization, accident report, disability, and outpatient visit). Standardized morbidity ratios, adjusted for age and presented in gender and rank-specific models, are used to compare risk among Soldiers in select Military Occupational Specialties. Separate models also compare risk among soldiers exposed to hazardous duty assignments such as parachuting and aviation. Results show that rates of head and neck injuries vary by occupation, receipt of hazardous duty pay, rank, and gender and by type of health outcome. These findings point to the need to monitor high-risk occupational specialties and to develop targeted interventions to reduce neck- and back-related morbidity. They also point to the need for more direct measurement of head-supported mass exposures and factors that may modify the association between risk exposures and injury or disability.

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# A BASELINE HISTORICAL ANALYSIS OF NECK AND BACK-RELATED MORBIDITY IN THE U.S. ARMY: OCCUPATIONAL RISKS POTENTIALLY RELATED TO HEAD-SUPPORTED MASS


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## TABLE OF CONTENTS

## LIST OF FIGURES



## LIST OF TABLES

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## LIST OF ACRONYMS

| | |
|---|---|
| CMF | Career Management Field |
| DMDC | Defense Manpower Data Center |
| MOS | Military Occupational Specialty |
| TAIHOD | Total Army Injury and Health Outcomes Database |
| HSM | Head-Supported Mass |
| TDRL | Temporary Disability Retirement List |
| MEB | Medical Evaluation Board |
| PEB | Physical Evaluation Board |
| SMR | Standardized Morbidity Ratio |
| VASRD | Veterans Administration System for Rating Disabilities |
| ICD-9-CM | International Classification of Diseases version 9, Clinical Modification |
| USASC | U.S. Army Safety Center (now renamed USACRC) |
| USACRC | U.S. Army Combat Readiness Center (formerly USASC) |

## EXECUTIVE SUMMARY

Neck and back injuries exact a significant human and economic toll on the health and readiness of the U.S. Army. Over a twenty year period of assessing hospital, disability, and accident reports, and a five year follow-up of outpatient visits, there were a total of 1,257,878 back or neck-related health encounters, with the vast majority of these (85%) due to back injury or conditions. Occupational exposures that increase risk of neck and back injury may include activities such as lifting heavy equipment, twisting, and increased strain caused by heavy loads worn in backpacks and on the head. In spite of the potential human and economic costs of such injuries, there have been few population-based epidemiological studies of neck or back injuries associated with head-loading and other occupational exposures among Soldiers.

Confounding is a central challenge to the evaluation of specific exposures, such as head-supported mass, as Soldiers using heavy head gear often experience other equipment-related or environmental risk factors that could also affect risk for neck or back injury. Data limitations also hamper our ability to directly study the influence of head-supported-mass and other occupational exposures on risk for neck and back injury. There is currently no way to directly measure this relationship using existing large population-based data sources, nor is it possible to directly isolate these effects from the role of other potential risk factors (i.e., increases in loads carried in ruck sacks). While we cannot directly measure head-supported mass as a risk factor for injury, we can study neck and back injuries in populations already known to be exposed to some degree of head-supported mass and compare them to unexposed occupational cohorts.

The primary goal of this study is to document the baseline morbidity of such conditions, particularly among populations at greatest potential or theoretical risk (e.g., pilots, parachutists). In establishing this baseline risk we create a context for evaluating the historical risk of injury among Army Soldiers, as well as future groups of Soldiers who may be asked to bear even greater amounts of head-supported mass.

Using data from the Total Army Injury and Health Outcomes Database (TAIHOD), including demographic, occupational and health information, we test the hypothesis that individuals in occupational specialties requiring the use of equipment that places a heavy load on the head will be at greater risk for acute and chronic neck and back injuries and musculoskeletal conditions. Analyses include calculation of frequencies and unadjusted rates of each health outcome (hospitalization, accident report, disability, and outpatient visit). Standardized morbidity ratios, adjusted for age and presented in gender and rank-specific models, are used to compare risk among Soldiers in select Military Occupational Specialty (MOS) groups, and exposure to hazardous duty assignments such as parachuting and aviation.

Rates of neck injury-related hospitalizations were much higher among enlisted personnel than among officers, while officers were more likely to receive care for neck injury in an outpatient setting, suggesting differences in severity and probably exposure. Parachuting was the single greatest source of hazardous duty exposure for both officers

and enlisted, but comprised a greater proportion of the population at risk among enlisted than officers. Receipt of hazardous duty pay for parachute exposure among officers was associated with lower risk for acute back and neck hospitalizations, disabilities, and outpatient visits, but increased risk for accidents reported to the Safety Center, compared to the general population of officers. Enlisted who received special pay for parachuting were also at significantly lower risk than the general enlisted population for acute or chronic back-related hospitalizations. However, they were at increased risk for chronic neck-related hospitalizations, acute neck outpatient visits, acute back injury accidents reported to the Safety Center and increased risk for back- or neck-related disabilities. For officers, flight pay was a greater source of hazardous duty exposure than for enlisted. It was also the only hazardous duty category associated with increased risk for hospitalization among the officers. It was associated with increased risk for chronic neck and back hospitalizations, outpatient visits, back-related accident reports, and disabilities. For enlisted, flight pay was associated with chronic neck-related hospitalizations and acute back injury accident reports, but with a lower risk for disability.

Certain occupational subgroups appear to be particularly vulnerable to neck and back problems. Healthcare workers in enlisted and officer ranks are at increased risk for acute and chronic back and neck problems, as reflected by increased hospitalizations and outpatient visits. However, these health encounters do not necessarily translate into increased risk for disability, as these same occupational subgroups are actually at lower risk for neck- and back-related disability. General officers and, to some degree, officers in administrative positions may be at increased risk for chronic neck and back problems. Since these occupational specialties are not generally highly physically demanding, the etiology of this association is unclear and warrants further investigation. Infantry Soldiers, as expected, are at increased risk for acute neck and back injuries, resulting in hospitalizations, accidents, and ultimately disabilities. They are at lower risk for outpatient visits related to neck or back problems, which might suggest that their neck and back injuries, when they do occur, are serious and related to trauma, as opposed to the neck and back problems encountered in other MOSs where the injury may be the result of repetitive but more minor trauma exposures. Food service workers appear to be at greater risk for back- but not neck-related problems, probably due to the types of lifting and carrying tasks they undertake in their food preparation work. Male and female military police are at increased risk for chronic neck and back hospitalizations, but not for acute hospital injury. However, only female military police are also at increased risk for back-related disabilities. Male military police are at lower risk. This is consistent with civilian studies that have found generally poorer outcomes for women than male workers with initial back-related problems.

This study points to the importance of subgroup analysis, as aggregation can hide important risk associations. For example, while the literature shows that medical care specialists, particularly nurses and orderlies, are at increased risk for back-related problems, and our aggregate data agree, the patterns differ by gender-specific specialties. Female licensed practical nurses are at particular risk for acute and chronic

back problems, and male 91A medical specialists (who also fall under the larger Career Management Field (CMF) heading of medical care) are at increased risk for back and neck acute and chronic conditions. There are also possible gender differences in exposures even for individuals within the same MOS. Male 91A medical specialists are at increased risk for acute and chronic back and neck hospitalizations, while female 91A medical specialists are only at increased risk for acute back hospitalizations. Nonetheless, female medical specialists are at increased risk for back-related disability, while male medical specialists are not.

These findings point to the need for further monitoring of high-risk occupational specialties, more direct measurement of head-supported mass, and other occupational exposures, as well as studies of factors that may modify the association between exposures and experience of injury or disability.

## BACKGROUND

Back and neck injuries exact a significant burden on the health and readiness of U.S. Army Soldiers. A study of Army hospitalizations for the year 1994 found that musculoskeletal injuries were the leading cause of hospitalization among active-duty Soldiers, and that back injuries in particular comprised a sizable proportion of these injuries, with intervertebral disc disorders and unspecified disorders each accounting for approximately 5% of all hospitalizations for musculoskeletal conditions in that year (15). Musculoskeletal conditions are also the leading cause of disability among active-duty Army Soldiers(2).

Occupational exposures that increase risk of neck and back injury may include activities such as lifting heavy equipment, twisting, and increased strain caused by heavy loads worn in backpacks and on the head. A 1997 study of Army Reserve Soldiers in a two-week Deployable Medical Systems training program also found that musculoskeletal injuries were the most common health condition of Soldiers in the training program, at 7.6 times the risk of these types of injury than Soldiers not undergoing training. Neck, shoulders, and low back were the most commonly injured body parts(14). Study of parachute injuries occurring at Fort Bragg between May 1993 and December 1994 found that back- and neck-related sprains and strains were the second most commonly reported injury(10). Civilian studies suggest that wearing heavy head gear, or otherwise putting a lot of weight on a person's head, so called "head-loading," increases risk for neck and back injuries and, in particular, increases risk for spondylosis and accentuates age-related decreases in spinal lordosis(20). In addition to the ballistic protection helmet worn by most Soldiers, there have been recent technological advances that have resulted in heavier helmets and, in some cases, changes in the center of gravity, through the addition of equipment to helmets such as night vision goggles and heads-up displays. With these advancements in technology there has been growing concern among the Army's medical and safety community that the associated increased load on the head and neck may increase risk of acute neck and back injuries, as well as chronic musculoskeletal conditions of the neck and back.

In spite of the potential human and economic costs of such injuries, there have been few population-based epidemiological studies of neck or back injuries associated with head-loading among Soldiers. Much of what is known about the health risks of head-supported mass comes from anecdotal reports of injuries among pilots and others in occupational groups with heavy head-loading equipment. The few studies that have been done have largely been limited to the experiences of a specific occupational subgroup (e.g., aviators, parachutists), and many of these studies have relied on individual case reports or limited case series(5, 16, 17, 22). Results from a few small epidemiological studies confirm anecdotal reports of increased neck and back injury among Soldiers in a few select occupational groups whose equipment includes relatively large amounts of head-supported mass. A survey of 231 rotary-wing Army pilots compared neck and spinal symptoms among pilots with relatively low and relatively high amounts of flight time (18). The majority (78%) reported spinal symptoms, and 40% attributed their symptoms to helmet weight, or the use of helmet-

mounted systems. Those who had logged a higher number of flight hours with helmet-mounted systems on a weekly basis were twice as likely to report spinal symptoms as those who had a lower number of weekly flight hours. Albano and Stanford documented a 56.6% one-year prevalence of self-reported neck pain among a group of 268 F-16 fighter pilots(1). Jones et al. published a paper in 2000 indicating that half of all fighter pilots responding to their survey (N=95) had experienced spinal pain during or just after their most recent flight(19).

Confounding is a central challenge to the evaluation of head-supported mass, as Soldiers using heavy head gear often experience other equipment-related or environmental risk factors that could also affect risk for neck or back injury. Parachutists, for example, face the combined risk of heavy ballistic protective head gear plus the impact of opening shock and landing. A 1997 study demonstrated that between 1993 and 1994, about a fifth of all parachute injuries were comprised of back and neck sprains and strains(10). However, this study could not explain whether the increased risk of back and neck injury was the result of the direct effect of protective head gear, heavy equipment, the impact of landing, or the synergistic affect of all these factors. Similarly, helicopter occupants are subject to numerous stressors in flight (e.g., yaw, G-forces, whole-body vibration), making it difficult to separate the effects of helmet weight from other risk factors for neck and back injury(8). Fighter pilots are also prone to neck and back pain, but it is not clear whether the weight of their headgear or the requirement to twist their heads around under variable G forces is the cause of their neck injury.

If increased head-loading does cause or contribute to increased risk for neck and back injury, then it is logical to assume reducing the weight of equipment, such as helmets, would reduce risk for these injuries. The author of a 1997 case study advocated the implementation of lighter helmets for parachutists in order to avoid severe neck injury(22). However, given the need for both ballistic and impact protection, it is not clear if this would necessarily be the most appropriate decision. Moreover, although the biomechanical aspects of neck musculature and cervical/spinal integrity have been fairly well studied with respect to an individual's theoretical risk for injury, the evidence linking the weight of a Soldier's helmet or other head-supported devices directly to injuries is still tenuous. A Finnish study tested two different helmets through a variety of flight maneuvers and found that reducing the weight of the helmet produced only a marginal decrease in the degree of neck muscle strain(16),(17).

While it is possible that some proportion of neck and back injuries or chronic musculoskeletal conditions is attributable to increased head-supported mass, there is currently no way to directly measure this relationship using existing large population-based data sources. Nor is it possible to directly isolate these effects from the role of other potential risk factors (i.e., increases in loads carried in ruck sacks). Many of the head-supported devices worn by aviators (e.g., night vision goggles) are worn by Soldiers in other Army occupations, such as tankers and other vehicle operators. Dismounted Soldiers may also wear these devices with regularity. Little is known about the effect of standard-issue or more specialized head-supported equipment on the general population of Army Soldiers, however. A population-based study that includes

dismounted Soldiers (i.e., flight crew members other than pilots and crew, who are not subject to in-flight forces) may allow the opportunity to parse out the effect of helmet weight from some of these other confounding or exacerbating factors.

In order to clarify the extent of the problem, and to determine which subgroups of Soldiers may be at greatest risk, we present a survey of acute and chronic conditions involving the neck and back across a broad range of occupational subgroups and medical outcomes (hospitalizations, disabilities, accident reports, and outpatient visits). While we cannot directly measure head-supported mass as a risk factor for injury, we can study neck and back injuries in populations already known to be exposed to some degree of head-supported mass and compare them to unexposed occupational cohorts.

Our purpose is primarily to document the baseline morbidity of such conditions, particularly among populations at greatest potential or theoretical risk (e.g., pilots, parachutists). In establishing this baseline risk we will create a context for evaluating the historical risk of injury among Army Soldiers, as well as future groups of Soldiers who may be asked to bear even greater amounts of head-supported mass. We hypothesize that individuals in occupational specialties requiring the use of equipment that place a heavy load on the head will be at greater risk for acute and chronic neck and back injuries and musculoskeletal conditions.

## METHODS

### THE DATA

All analyses rely on data from the Total Army Injury and Health Outcomes Database (TAIHOD). Details describing this database have been published elsewhere(3, 4). In brief, the TAIHOD links demographic, occupational, and health information from Department of Defense (DoD) administrative agencies at the level of the individual Soldier. These analyses use data from personnel files (demographic and occupational characteristics), hospitalization files, outpatient encounters, disabilities, and coded accounts of accidents reported to the U.S. Army Safety Center.

#### Study Population

All Army Soldiers on active duty between January 1, 1980, and December 31, 2002, were included in this analysis. Data were not available for outpatient encounters during the early years of the study period as described below under Outcome Measures. Eligibility for inclusion in the study was dependent upon presence of a personnel file from the Defense Manpower Data Center (DMDC) within 1 year of the outcome measure event (e.g., hospitalization). DMDC personnel data are incorporated into the TAIHOD semiannually, in June and December. The TAIHOD master personnel files contain demographic attributes of all Army personnel on active duty during the month in which the file is produced. For each outcome of interest, we searched the closest DMDC file immediately following the event and, if that file was missing, we searched the file immediately prior to the event date. If both files were missing, we dropped the Soldier from the analysis file.

In addition to using the DMDC to assess study eligibility and for the calculation of rates during each study period, we used the following demographic characteristics from the personnel files in these analyses: age, gender, and rank.

## Outcome Measures

Neck and back-related injuries and conditions were evaluated using four different health outcome measures: hospitalizations, disabilities, unit reports of accidents to the Safety Center, and outpatient encounters.

**Hospitalizations.** We identified hospitalizations where the primary ICD-9-CM codes specified either an acute or a chronic back or neck injury. Table 1 displays the list of conditions included for this study. If an individual was hospitalized more than once for a neck or back condition, the hospital event was counted each time they were hospitalized (though hospital transfers[1] that resulted in an additional hospital record as part of continuing care for the same initial injury were only counted once).

[1]Transfer hospital records were distinguished from unique hospital events primarily by the presence of a "transfer out" code on the initial record, and/or a "transfer in" code in the subsequent record.

## Table 1. ICD-9-CM Codes Used to Identify Acute and Chronic Back and Neck-Related Injuries and Conditions.

| Category | ICD-9-CM Codes | Diagnosis Label |
|---|---|---|
| Acute Neck Injury | 805.0 - 08 | Cervical, closed fracture, spinal injury not mentioned |
| | 805.1 - 17 | Cervical, open fracture |
| | 806.0 | Cervical closed fracture, unspecified spinal cord injury |
| | 806.00 | C1-C4 level with unspecified spinal cord injury |
| | 806.01 | C1-C4 level with complete lesion of cord |
| | 806.02 | C1-C4 level with anterior cord syndrome |
| | 806.03 | C1-C4 level with central cord syndrome |
| | 806.04 | C1-C4 level with other specified spinal cord |
| | 806.05 | C5-C7 level with unspecified spinal cord injury |
| | 806.06 | C5-C7 level with complete lesion of cord |
| | 806.07 | C5-C7 level with anterior cord syndrome |
| | 806.08 | C5-C7 level with central cord syndrome |
| | 806.09 | C5-C7 level with other specified spinal cord |
| | 806.1 | Cervical, open, unspecified cord damage |
| | 806.11 | C1-C4 level with complete lesion of cord |
| | 806.12 | C1-C4 level with anterior cord syndrome |
| | 806.13 | C1-C4 level with central cord syndrome |
| | 806.14 | C1-C4 level with other specified spinal cord |
| | 806.15 | C5-C7 level with unspecified spinal cord injury |
| | 806.16 | C5-C7 level with complete lesion of cord |
| | 806.17 | C5-C7 level with anterior cord syndrome |
| | 806.18 | C5-C7 level with central cord syndrome |
| | 806.19 | C5-C7 level with other specified spinal cord |
| | 847.0 | Neck |
| | 839.0 | Cervical vertebra, closed |
| | 839.00 | Cervical vertebra, unspecified |
| | 839.01 | First cervical vertebra |
| | 839.02 | Second cervical vertebra |
| | 839.03 | Third cervical vertebra |
| | 839.04 | Fourth cervical vertebra |
| | 839.05 | Fifth cervical vertebra |
| | 839.06 | Sixth cervical vertebra |
| | 839.07 | Seventh cervical vertebra |
| | 839.08 | Multiple cervical vertebrae |
| | 839.10 | Cervical vertebra, unspecified |
| | 839.1 | Cervical vertebra, open |
| | 839.11 | First cervical vertebra |
| | 839.12 | Second cervical vertebra |
| | 839.13 | Third cervical vertebra |
| | 839.14 | Fourth cervical vertebra |
| | 839.15 | Fifth cervical vertebra |
| | 839.16 | Sixth cervical vertebra |
| | 839.17 | Seventh cervical vertebra |
| | 839.18 | Multiple cervical vertebrae |
| Chronic Neck Conditions | 721.0 | Cervical spondylosis without myelopathy |
| | 721.1 | Cervical spondylosis with myelopathy |
| | 722.0 | Displacement of cervical intervertebral disc without myelopathy |
| | 722.4 | Degeneration of cervical intervertebral disc |
| | 722.71 | Intervertebral disc disorder w/ myelopathy, cervical region |

| Category | ICD-9-CM Codes | Diagnosis Label |
|---|---|---|
| | 722.81 | Postlaminectomy syndrome, cervical region |
| | 722.91 | Other/unspecified disc disorder, cervical region |
| | 723.0 | Spinal stenosis of cervical region |
| | 723.1 | Cervicalgia |
| | 723.2 | Cervicocranial syndrome |
| | 723.3 | Cervicobrachial syndrome (diffuse) |
| | 723.4 | Brachial neuritis or radiculitis NOS |
| | 723.5 | Torticollis, unspecified |
| | 723.6 | Panniculitis specified as affecting neck |
| | 723.7 | Ossification of posterior longitudinal ligament |
| | 723.8 | Other syndromes affecting cervical region |
| | 723.9 | Unspecified musculoskeletal disorders and symptoms |
| | 738.2 | Acquired deformity of neck |
| | 739.1 | Non-allopathic lesions, NOS, cervical region |
| Acute Back Injury | 846.0 | Sprain/Strain: Lumbosacral (joint) (ligament) |
| | 846.1 | Sprain/Strain: Sacroiliac ligament |
| | 846.2 | Sprain/Strain: Sacrospinatus (ligament) |
| | 846.3 | Sprain Strain: Sacrotuberous (ligament) |
| | 846.8 | Sprain/Strain: Other specified sites of sacroiliac region |
| | 846.9 | Sprain/Strain: Unspecified site of sacroiliac region |
| | 847.2 | Sprain/Strain Lumbar |
| | 847.3 | Sprain/Strain Sacrum |
| | 847.9 | Sprain/Strain Unspecified site of back |
| Chronic Back Conditions | 722.1 | Displacement of thoracic or lumbar intervertebral disc |
| | 722.2 | Displacement of intervertebral disc, site unspecified |
| | 722.10 | Lumbar intervertebral disc without myelopathy |
| | 722.70 | Intervertebral disc disorder with myelopathy, unspecified region |
| | 722.73 | Intervertebral disc disorder w/ myelopathy, lumbar region |
| | 721.3 | Lumbosacral spondylosis without myelopathy |
| | 721.5 | Kissing spine |
| | 721.6 | Ankylosing vertebral hyperostosis |
| | 721.7 | Traumatic spondylopathy |
| | 721.8 | Other allied disorders of spine |
| | 722.6 | Degeneration of intervertebral disc, site unspecified |
| | 721.90 | Spondylosis of unspecified site, without mention of myelopathy |
| | 721.91 | Spondylosis of unspecified site, with mention of myelopathy |
| | 722.52 | Lumbar or lumbosacral intervertebral disc |
| | 722.90 | Disc disorder, unspecified region |
| | 722.93 | Disc disorder, lumbar region |
| | 721.42 | Spondylosis with myelopathy, lumbar region |
| | 724.6 | Disorders of sacrum |
| | 738.4 | Acquired spondylolisthesis |
| | 756.11 | Spondylolysis, lumbosacral region |
| | 756.12 | Spondylolisthesis |
| | 724.2 | Lumbago |
| | 724.5 | Backache, unspecified |
| | 724.3 | Sciatica |
| | 724.4 | Thoracic or lumbosacral neuritis or radiculitis |
| | 724.8 | Other symptoms referable to back |
| | 724.9 | Other unspecified back disorders |
| | 738.5 | Other acquired deformity of back or spine |
| | 739.3 | Non-allopathic lesions, NOS, lumbar region |
| | 739.4 | Non-allopathic lesions, NOS, sacral region |
| | 722.30 | Schmorl's nodes, unspecified region |

| Category | ICD-9-CM Codes | Diagnosis Label |
|---|---|---|
| | 722.32 | Schmorl's nodes, lumbar region |
| | 724.00 | Spinal stenosis, unspecified region |
| | 724.02 | Spinal stenosis, lumbar region |
| | 724.09 | Spinal stenosis, other back (non-cervical) |
| | 307.89 | Psychogenic backache (back pain) |
| | 720.0 | Ankylosing spondylitis |
| | 720.1 | Spinal enthesopathy |
| | 720.2 | Sacroiliitis, NEC |
| | 720.81 | Other inflammatory spondylopathies |
| | 720.89 | Other inflammatory spondylopathies |
| | 722.5 | Degeneration of thoracic or lumbar intervertebral disc |
| | 722.51 | Thoracic or thoracolumbar intervertebral disc |
| | 724.70 | Unspecified disorder of coccyx |
| | 724.71 | Hypermobility of coccyx |
| | 724.79 | Other disorders of coccyx |

**Disabilities.** Soldiers experiencing a disabling injury must go through an initial physical exam and a Medical Evaluation Board (MEB) review of their condition. A large proportion of these individuals are subsequently referred to a Physical Evaluation Board (PEB). At the PEB, unless found "fit for duty," the Soldier is assigned a functional disability code along with a rating indicating a "percent disability." The Army uses the Veterans Administration Schedule for Rating Disabilities (VASRD) to describe and rate disabilities. We identified 11 VASRD codes that are associated with neck conditions and 11 associated with back conditions (Table 2). It is not possible to differentiate between acute and chronic conditions within the VASRD. However, as the PEB is generally evaluating injury-related conditions well after the acute injury event has transpired, disability outcomes are considered "chronic" for the purposes of this analysis. The VASRD coding system tends to be rather broad and non-specific, so sometimes it is not possible for the disability agency to assign a code that precisely describes a particular condition. When a precise VASRD code is unavailable, the code that most closely describes the condition is instead chosen and the record is flagged to indicate that an "analogous code" has been used. For the purposes of analysis, we made no distinction between disability cases with analogous codes and those with regular VASRD codes, since it was not practically possible to obtain any more specific information regarding conditions with the analogous code. While each record could have up to 4 VASRD codes, we evaluated cases based only on the primary (first) VASRD code.

If a Soldier's condition is not stable at the time of the initial PEB evaluation, they may be placed on the Temporary Disability Retirement List (TDRL). A TDRL status is most likely to occur for individuals whose condition may eventually improve sufficiently to return to active duty, or whose condition may deteriorate enough that their compensation or care may need to be reconsidered. Individuals placed on the TDRL must be evaluated at least every 18 months, not to exceed 5 years before a final disposition is recorded. This process usually produces multiple database records per individual. In the case of multiple records, VASRD codes and disability ratings were

drawn from the first disability evaluation record. We matched disability evaluations to the DMDC extract following the date of the initial physician's exam. If this date was not available we used the date of the MEB evaluation. If the MEB evaluation date was also not available, we used the date the case was received by the disability agency. The case received date was used in less than 1% of the cases. Thus, our final study group included all Soldiers who were evaluated by the United States Army Physical Disability Agency between 1980 and 2002 who had a primary VASRD code indicating they had a neck or back disability and who matched the DMDC within 1 year of the disability evaluation event date (Table 2).

**Table 2. VASRD Disability Codes Used to Identify Neck- and Back-Related Disability Cases.**

| Category | VASRD Codes | Diagnosis Label |
|---|---|---|
| Neck-related disability | 5287 | Spine, ankylosis of, cervical |
| | 5290 | Spine, limitation of motion of, cervical |
| | 5320 | Group XX. Spinal muscles |
| | 5322 | Group XXII. Lateral, supra and infrahyoid group |
| | 5323 | Group XXIII. Lateral and posterior muscles of the neck |
| | 8510 | Paralysis of Upper radicular group (fifth and sixth cervicals) |
| | 8610 | Neuritis. Upper radicular group (fifth and sixth cervicals) |
| | 8710 | Neuralgia. Upper radicular group (fifth and sixth cervicals) |
| | 8513 | Paralysis of All radicular groups |
| | 8613 | Neuritis. All radicular groups |
| | 8713 | Neuralgia. All radicular groups |
| Back-related disability | 5285 | Residuals of fractures of vertebra |
| | 5286 | Spine, complete bony fixation (ankylosis) |
| | 5288 | Spine, ankylosis of, dorsal |
| | 5289 | Spine, ankylosis of, lumbar |
| | 5291 | Spine, limitation of motion, dorsal |
| | 5292 | Spine, limitation of motion, lumbar |
| | 5293 | Intervertebral disc syndrome |
| | 5294 | Sacro-iliac injury and weakness |
| | 5295 | Lumbosacral strain |
| | 5316 | Pelvic Girdle group |
| | 5320 | Group XX. Spinal muscles |

**Accident Reports.** The U.S. Army Safety Center investigates accidents involving military personnel that result in bodily harm or significant losses due to property damage(12, 13). These mishap reports capture information on the type of injury (e.g., fracture, dislocation) and the body part affected (e.g., arm, leg, head) during these primarily acute, injury events. We selected reports of accidents occurring between 1980 and 2002 and included them if the injured Soldier experienced a fracture, dislocation, sprain, or contusion to the neck or back, regardless of cause.

**Outpatient Visits.** Army data on outpatient encounters have only recently become available in an electronic format. The first full calendar year in which electronic data of reasonable quality were available was 1998. Data from January 1, 1998, through September 30, 2002, were used for these analyses. We identified outpatient

encounters with primary diagnoses relating to the neck or back using the same list of ICD-9-CM codes used in the analysis of inpatient hospitalizations (Table 1).

## Risk Factors

**Occupational Exposures.** Demographic data from the DMDC personnel files include occupational information such as CMF and MOS. CMFs are broadly defined occupational groupings of similar MOS. We initially compared CMFs in order to evaluate differences in the relative risk for neck and back injury between broad occupational groups across the whole Army. Because CMFs are rank specific (i.e., there are different groupings for officers and enlisted personnel), we evaluated trends in neck and back injury by broad CMFs separately for officer and enlisted Soldiers. CMF analyses provide a good overview of neck and back injury across the Army and, due to the level of aggregation, provide enough power to evaluate all groups. Table 3 displays CMFs for officer and enlisted Soldiers.

**Table 3. Army Career Management Fields for Officers and Enlisted Soldiers.**

| Officers | Enlisted |
|---|---|
| General Officer/Executive | Infantry |
| Tactical Operations | Electrical Equipment Repair |
| Intelligence | Communication/Intelligence |
| Engineering & Maintenance | Health Care |
| Scientists & Professionals | Technical/Allied Specialist |
| Health Care | Support/Administration |
| Administrators | Electrical/Mechanical Equip Rep |
| Supply, Procurement, & Allied | Craftsworkers |
| Non-occupational* | Service/Supply |
| Other | Non-occupational* |
| | Other |

*Includes basic trainees, students, prisoners, and patients.

MOS codes are more specific than CMFs and meant to reflect actual job training and responsibilities. However, because many MOSs may be aggregated within a single CMF, this may mask the influence of exposures particular to certain MOSs within broad CMFs. To better understand how more specific occupational risks might affect neck and back injury, we conducted a subanalysis of the most common MOS among male and female Soldiers. Analyses were performed separately for male and female Soldiers because some MOSs are open to men only and, because the population is so disproportionately male, combined models may have masked gender differences in risk for those MOSs open to both men and women.

Upon entering the Army, a Soldier is assigned to an MOS and trained to perform that particular job (referred to as the Primary MOS). Over the course of a Soldier's Army career, however, he or she may be assigned to different jobs or duty assignments. In that case, the Soldier also receives a Duty MOS code describing the job the Soldier is actually performing. In our study, we classified occupational exposures using the Duty

MOS when it was indicated in the DMDC records. If Duty MOS was not indicated, the Primary MOS was used.

Because MOSs were so numerous and were often sparsely populated, making statistical analyses impractical, we selected the twelve most common MOSs for men and women separately. Our initial analytic effort included both enlisted and officers. However, preliminary analyses of the population of female and male officers within individual MOSs indicated that the number of outcomes (e.g., hospitalizations or disability evaluations for neck injuries) within a specific MOS would not produce sufficient statistical power for meaningful comparisons in our officer cohorts. Thus, the MOS subanalysis includes only enlisted male and female Soldiers.

Because the relative size of an MOS may change over time, we took steps to avoid creating a temporally biased sample in identifying the largest MOS for male and female enlisted Soldiers. We compared the total person-time attributed to each MOS for male and female enlisted Soldiers between 1980 and 2002 and then selected the twelve most common occupations (Table 4). Six of the twelve most common MOSs selected for men and women are open to both male and female Soldiers. These are military police (95B), light-wheeled vehicle mechanic (63B), food service specialist (94B), unit supply specialist (76Y), medical specialist (91B), and administrative specialist (71L).

The largest MOS for enlisted male Soldiers was Infantry (11B), accounting for 9% of the total person-time contributed by men throughout the study period. Administrative Specialist (71L), the largest MOS among women, accounted for 11% of the total person-time contributed by women throughout the study period. The top 12 MOSs accounted for approximately 36% and 40% of the total person time for active duty enlisted men and women, respectively.

**Table 4. Twelve Largest Army Enlisted Military Occupational Specialties by Gender.**

| Enlisted men | % of total person time | Enlisted women | % of total person time |
|---|---|---|---|
| 11B Infantryman | 9% | 71L Administrative Specialist | 11% |
| 13B Cannon Crewmember | 4% | 91A/B Medical Specialist | 4% |
| 95B Military Police | 4% | 76Y Unit Supply Specialist | 4% |
| 63B Light Wheeled Mechanic | 3% | 94B Food Service Specialist | 4% |
| 94B Food Service Specialist | 2% | 95B Military Police | 3% |
| 12B Combat Engineer | 2% | 75B Personnel Administration | 2% |
| 76Y Unit Supply Specialist | 2% | 91C Licensed Practicing Nurse | 2% |
| 91A/B Medical Specialist | 2% | 63B Light Wheeled Mechanic | 2% |
| 71L Administrative Specialist | 2% | 88M Motor Transport Operator | 2% |
| 19K Armor Crewman | 2% | 92A Logistical Specialist | 2% |
| 19D Cavalry Scout | 2% | 92Y Unit Supply Specialist | 2% |
| 11M Fighting Vehicle Infantryman | 2% | 77F Petroleum Supply Specialist | 2% |

**Hazardous Duty.** Servicemembers who regularly do jobs that are dangerous, either due to environment exposures or materials handled, are entitled to hazardous duty incentive pay. The pay is generally the same for officers and for enlisted personnel--$150 a month with the exception of flight pay, which varies for officers based on the duration of their aviation service. Servicemembers can collect up to two different types of hazardous duty pay in a given pay period, provided that the unit and position in which they work require the performance of both types of duty.

The TAIHOD includes hazardous duty compensation records from the year 1985 to the present. Thus, analyses involving hazardous duty exposures could be conducted only from 1985 forward. An error in the Defense Finance and Accounting Center report to DMDC resulted in a substantial number of missing pay variables for 2002 hazardous duty pay. Because of this missing data, 2002 pay files had to be reconstructed using other related pay variables as proxies.

Exposure to hazards such as flying and parachuting varies within and between occupational groups. For example, most recipients of parachute pay come from infantry MOS, though not all infantry MOS perform parachuting duties. Excess injury risk

related to this exposure has been documented(7). To identify individuals who might have been exposed to specific risks for neck and back injury (e.g., flying, parachuting, demolition duty), we created five comparison groups using selected hazardous duty compensation records.

1. Soldiers receiving hazardous duty pay for flying either as a crew member or a non-crew member, but not receiving hazardous duty pay for parachuting;
2. Soldiers receiving hazardous duty pay for parachuting, but not for flying;
3. Soldiers receiving hazardous duty pay for both flying and parachuting;
4. Soldiers receiving hazardous duty pay for demolition duty;
5. Soldiers receiving hazardous duty pay for sustained periods of time--two levels:
    a. Top $10^{th}$ percentile,
    b. Top $20^{th}$ percentile.

Individuals could be included in any or all of the first four categories if they received the described hazardous duty pay at any time during the follow up period. Two sustained hazardous duty exposure categories were created: a “top 10%” category and a “top 20%” category. Individuals were included in these categories if the total number of months in which they received hazardous duty pay was either in the top $10^{th}$ percentile, or the top $20^{th}$ percentile of all hazardous duty pay recipients. Individuals receiving hazardous duty pay for the longest amount of time, qualifying them for the top 10% category, received hazardous duty pay for seven years or more.

For outcomes including hospitalizations, disabilities, and recorded accidents, the follow-up period was 1985-2002. The follow-up period for outpatient encounters was shorter (1998-2002) than for the other outcomes reflecting the more recent availability of electronic outpatient data. In order to define the high risk hazardous duty among individuals treated as outpatients during this study period, we included the total number of months between 1998 and 2002 during which the individual drew hazardous duty pay. For consistency with the other outcome analyses, we also used the top 10th and 20th percentiles of hazardous duty receivers in this shorter follow-up time period to define the high risk cohorts. For the 60-month outpatient study period, the top 10% of hazardous duty pay recipients were found to have received hazardous duty pay for at least 48 months. Because of variations in demographics likely associated with more recent time periods and shorter follow-ups, it would not be wise to compare patterns between hazardous duty pay receipt and outpatient outcomes to hazardous duty pay receipt and other health outcomes with longer follow-up times used to define top 10% and 20% risk groups.

While hazardous duty pay is a useful proxy for identifying exposures to some potential risk factors for neck and back injury, there are some limitations. First, the pay does not indicate the degree of exposure; it only indicates qualification by meeting the minimum requirements for receipt of the pay in a given month. Thus, an individual who makes seven parachute jumps in a month earns the same pay as an individual who makes one jump. Second, the month in which the pay is received is not necessarily the

month in which the pay was earned. This can happen because a parachutist must make a minimum of one jump every three months in order to qualify for jump pay for three full months. Similarly, an aviator can qualify for flight pay based on an excess of hours earned either in the months prior or subsequent to the month in which the pay is received. Thus, while hazardous duty pay is an excellent way to identify individuals who are exposed to hazardous duty, it is not as useful for pinpointing when the exposure actually occurred, nor the total amount of exposure to risk. Caution should be used when interpreting these findings.

## Analytic Approach

Initial descriptive analyses document the frequency and unadjusted rates of neck and back injuries in hospital, outpatient, disability, and safety data. Next, in order to compare risk of injury among Soldiers in these high-risk occupations (e.g., those occupational specialties that routinely use heavy head-gear), we used standardized morbidity ratios (SMR).

The SMR is a ratio of the observed and expected morbidities in the population of interest. SMRs allow for the comparison of the morbidity experience in the population of interest to the morbidity experience of a general reference population while controlling for the effects of confounding variables such as age. The expected morbidity estimates are derived using observed morbidity data from an appropriately chosen reference group--in this case, the general Army population. An SMR near 1 indicates similar morbidity rates between the comparison group and the reference population. Similarly, SMRs less than 1 indicate lower morbidity rates, and an SMR greater than 1 suggests higher morbidity rates in the comparison group.

The expected morbidity within each CMF, MOS, and hazardous duty pay group is estimated using the overall morbidity in the reference group under the null hypothesis of "no difference." The ratio of this estimate to the actual morbidity observed in each of the CMF, MOS, and Hazardous Duty Pay groups provides the unit-free measure of comparison. The SMR is

$$SMR = 100 \cdot \frac{\sum_{i=1}^{n} \left(\text{observed injury in local population}\right)_i}{\sum_{i=1}^{n} \left[ \left( \frac{\text{observed injury in reference population}}{\text{person} - \text{years in reference population}} \right)_i \cdot \left(\text{person} - \text{years in local population}\right)_i \right]},$$

where n is the number of levels of the stratification variable (an independent variable chosen for its association with both the morbidity rate and the risk factor of interest). Influential effects of independent variables (confounders) are controlled using the indirect method of adjustment. The indirect method uses strata-specific rates in the reference population that are averaged over the levels of a stratification variable using the distribution of person-time in the study population as weights. While this approach does allow us to compare rates in the subpopulation of interest (e.g., specific MOS) to the overall population, it is not technically correct to compare SMRs for each MOS to each other.

Models were gender differentiated in order to account for gender-specific occupational exposures and to allow us to control for known gender differences in risk for neck and back injury. We stratified our analyses on age because age has been shown to be correlated with risk of neck and back injury. The comparison and the reference groups are partitioned into the following age categories: under 21 years, 21–25 years, 26–30 years, 31–35 years, 36–40 years, and over 40 years of age.

Ninety-five percent confidence intervals for the Standard Morbidity Ratio were also calculated.

$$Lower\ 95\%\ CI = \left[\left(\text{observed}\cdot\left(1-\left(1/\left(9\cdot\text{observed}\right)\right)\right)-\left(1.96/3\cdot\sqrt{1/\text{observed}}\right)\right)^3\right] \Big/ \left(\text{expected}\right)$$

$$Upper\ 95\%\ CI = \left[\left(\text{observed}+1\right)\cdot\left(1-\left(1/\left(9\cdot\left(\text{observed}+1\right)\right)\right)+\left(1.96/3\right)\cdot\sqrt{1/\text{observed}+1}\right)^3\right] \Big/ \left(\text{expected}\right)$$

## Adjustments to Person-Time Calculations

Person years of exposure were calculated for Army Soldiers who were on active duty during the study periods associated with each outcome (hospitalization, disability, reportable accident, and outpatient visits). The range of years for each follow-up period was based on and limited to the years in which both outcome and occupational data were available.

TAIHOD DMDC personnel data updates include demographic and occupational characteristics for all Army personnel who are on active duty at the end of a particular six-month period ending in either June or December. Therefore, persons leaving the Army will not be found in the DMDC installment following the date they are discharged. Persons joining the Army will first appear in the TAIHOD DMDC file following the date they begin basic training. Because demographic and occupational attributes were available in June and December only, person-years were accumulated in six-month counting units. A three-month adjustment was applied to the beginning and end of each individual's term in order to adjust for exposures that would, on average, occur prior to the Soldier's first DMDC record or after their last DMDC record if they were discharged from the Army during the follow-up period. Although individuals may have entered the Army at any time during this six-month period, an average of three months is credited to all individuals at the beginning of their first DMDC record in order to more accurately reflect total exposure time (person time) in the Army. An exception is made for all individuals whose tenure of service was already in progress at the start of the study. These individuals were credited with the full six months of service for this first six-month period, since the existence of an earlier DMDC file serves as a confirmation of their presence for a full six-month interval. Person-time is accumulated in six-month units until the last record belonging to the individual is encountered. The last record indicates that the person was on active duty at the time the previous DMDC extract was made, but was discharged from the Army at some point during the following six months (before the next semiannual extract was taken). The last record increases the count by nine months, representing the six months that the individual has served since they appeared

in the previous DMDC installment, and an estimated three months on average that the individual will serve during the following six-month period before leaving the Army. The additional three months is not applied if the last DMDC file that the individual appears in corresponds to the last six months of the overall study, since no outcome data will be collected outside of the study interval. A separate consideration is made if there is only one six-month record on file for an individual. In this case, the individual contributes six months of exposure person-time, which includes the three months served prior to the date of the only DMDC file they appear in, and three months following it, which approximates time served before leaving the Army.

As with the date of entry to and exit from the military, updates to the stratification variable, age, were documented semiannually. When an individual reaches an age that elevates them to the next age group, the six months of person-time is split between the two age groups. Three months of service are applied to the original age group, representing the average time served before the birthday. Likewise, three months of service are applied to the next higher age group, representing the average time served at the higher age group.

### The Reference Populations

The reference population plays an important role in the interpretation of the SMR. Because the reference population is used to estimate the expected morbidity of the subgroup of interest (e.g., a particular MOS), only SMRs for subgroups from the same reference population can be compared. Demographic and occupational characteristics, as well as management practices, may be quite different among enlisted and officer ranks; thus, it was necessary to create separate reference populations for the enlisted and officer analyses. SMRs for the enlisted occupational cohorts should not be compared to SMRs for officer occupational cohorts because the referent populations for enlisted and officers differ.

We identified four reference populations in this study: For SMRs using hospital, disability, and safety data, reference populations included (1) all active duty enlisted Army Soldiers serving between 1980 and 2002, and (2) all active duty Army officers serving between 1980 and 2002. For SMRs with the outpatient data, the reference populations used were (3) all active duty enlisted Army Soldiers serving between 1998 and 2002, and (4) all active duty Army officers serving between 1998 and 2002. For the hazardous duty analyses, the two reference populations used in the former analyses were truncated so that only the time period from 1985-2002 was used.

## RESULTS

### FREQUENCIES AND UNADJUSTED RATES OF NECK AND BACK INJURIES AND CONDITIONS

Table 5 displays the frequency of neck- and back-related conditions observed during the study period, stratified by rank. During the study period there were a total of 1,257,878 back- or neck-related health encounters and/or disability-related diagnoses.

The vast majority (85%, N = 1,072,643) were for back-related conditions. However, there were significant rank associations such that officers were relatively more likely than enlisted to experience a neck injury versus back injury. Thirteen and a half percent of enlisted Soldier neck- and back-related encounters were related to neck problems, while 23.5% of officer neck- and back-related injury encounters were for neck problems. However, officers with acute neck injuries were more likely than enlisted with acute neck injuries to be treated in an outpatient setting, suggesting officer neck injuries may be less serious; 9.2% of enlisted with acute neck injuries were hospitalized compared to 3.4% of officers with acute neck injuries treated in either hospital or outpatient setting.

Between 1980 and 2002, there were a total of 7,944 hospitalizations for acute neck and 39,179 chronic neck and back conditions among enlisted and officer servicemembers. The rate of hospitalization among enlisted Soldiers was higher than for officers at 6.2 per 10,000 person years versus 2.6 per 10,000 person years (data not shown). The majority of the hospitalizations for chronic neck conditions were diagnosed neck pain followed by intervertebral disc disorder, spondylosis with myelopathy, and segmental/somatic dysfunction. Acute neck injuries were primarily sprains and strains, followed by fractures and dislocations.

In this same time period there were 1,124 enlisted Soldiers and 94 officers who underwent disability evaluations for neck-related conditions, and 13,669 enlisted Soldiers and 703 officers received a disability rating for a back condition. Also, during this same time period there were 8,467 Safety Center reports documenting neck or back injuries among enlisted Soldiers, and 661 reports documenting neck or back injuries among officers. There were 2,746 fractures (Enlisted N=2512, Officer N=234), 5,055 Sprains and Strains (Enlisted N=4693, Officers N=362), 1,197 Contusions (Enlisted N=1140, Officers N=57), and 130 Dislocations (Enlisted N=122, Officers=8) (data not shown).

Between January 1, 1998, and September 30, 2002, there were 131,507 acute and 1,054,530 chronic neck and back injury outpatient visits. The majority of outpatient visits (N=57,120) were related to neck pain, 8,354 were for intervertebral disc disorder, 2,314 were for spondylosis with myelopathy, and 7,063 were for segmental/somatic dysfunction. Of all acute neck-related problems seen in the outpatient setting, 22,867 were for treatment of sprains and strains. There were also 393 fractures and 340 neck dislocations seen during this time period (Data not shown).

**Table 5. Neck and Back Injuries and Conditions among Active Duty Army Soldiers.**

| | Neck | | Back | | **Total** |
|---|---|---|---|---|---|
| | Enlisted | Officer | Enlisted | Officer | |
| Inpatient Hospitalizations* | | | | | |
| Acute Injury | 3,664 | 209 | 3,781 | 290 | **7,944** |
| Chronic Musculoskeletal Conditions | 4,106 | 1,169 | 28,587 | 5,317 | **39,179** |
| Disability Evaluations* | 1,124 | 94 | 13,669 | 703 | **15,590** |
| Safety Reports* | 2,779 | 162 | 5,688 | 499 | **9,128** |
| Outpatient Encounters** | | | | | |
| Acute Injury | 36,036 | 5,999 | 80,721 | 8,751 | **131,507** |
| Chronic Musculoskeletal Conditions | 102,237 | 27,656 | 825,128 | 99,509 | **1,054,530** |
| **TOTAL** | **149,946** | **35,289** | **957,574** | **115,069** | **1,257,878** |

*1980-2002

**1998-2002

Note: Categories are not mutually exclusive. For example, a Soldier presenting with a neck injury in the outpatient clinic might also be hospitalized and ultimately receive a disability evaluation. Also note that Soldiers may experience the outcome (e.g., hospitalization) in more than one study period. Thus, frequencies presented in this table represent events and not individuals.

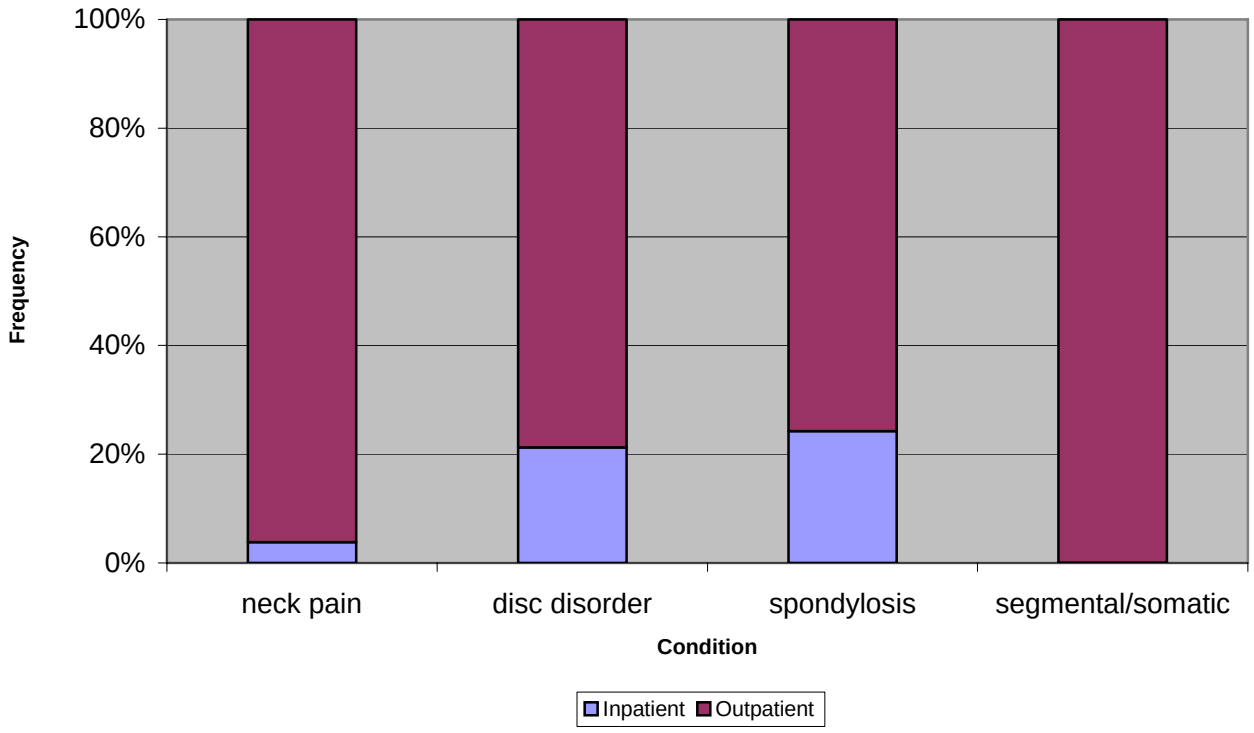
Table 6 shows the distribution of the study cohort by hazardous duty exposures. While parachute duty was the most frequently listed hazardous duty exposure for both enlisted and officers, it was a much more common exposure among enlisted than officers. Eighty-two percent of enlisted Soldiers receiving hazardous duty pay were exposed to parachuting, compared to 59% of officers receiving hazardous duty pay. Officers were more likely to be exposed to flight duty-related hazards than were enlisted Soldiers. Twenty-one percent of officers receiving hazardous duty pay received their special pay due to flying, compared to just 2% of enlisted Soldiers receiving hazardous duty pay. The bottom portion of the table describes Soldiers receiving hazardous duty pay for sustained periods of time. For officers, the most frequent reason for continued receipt of hazardous duty pay was for flight duty. For enlisted, the most common reason for continued or multiple receipts of hazardous duty pay was for parachute duty.

**Table 6. Hazardous Duty Exposure for Enlisted Soldiers and Commissioned Officers.**

| Enlisted | | Officers | |
|---|---|---|---|
| **Hazardous Duty Cohorts** | **N** | **Hazardous Duty Cohorts** | **N** |
| Parachute Duty | 153,876 | Parachute Duty | 29,213 |
| Flight Duty | 3,609 | Flight Duty | 10,268 |
| Parachute & Flight Duty | 3,808 | Parachute & Flight Duty | 1,600 |
| Demolition Duty | 4,227 | Demolition Duty | 779 |
| Demolition Only | 3,253 | Demolition Only | 577 |
| Demolition & Flight | 41 | Demolition & Flight | 9 |
| Demolition & Parachute | 916 | Demolition & Parachute | 189 |
| Demolition, Flight & Parachute | 17 | Demolition, Flight & Parachute | 4 |
| High Frequency Cohort (top 10%) | 21,907 | High Frequency Cohort (top10%) | 7,308 |
| Parachute Duty | 16,766 | Parachute Duty | 2,917 |
| Flight Duty | 3,632 | Flight Duty | 3,546 |
| Flight & Parachute Duty | 1,509 | Flight & Parachute Duty | 845 |

Even with the much shorter follow-up time for outpatient visits, they far outnumber inpatient visits. However, the ratio of outpatient to inpatient visits varies by specific type of back- or neck-related disorder. Figure 1 shows the relative proportion of outpatient visits to hospitalizations for several specific neck- and back-related conditions. The chart demonstrates that for Soldiers with spondylosis or disc disorders, hospitalization may be more likely than conditions related to neck pain or segmental/somatic disorders.

**Figure 1. Chronic neck conditions: Comparing hospitalizations to outpatient visits (1998-2002)**



There were 1,218 neck-related disabilities reported during the study period. Specific neck-related disability diagnoses are explored in Table 7. Limitation of motion of the cervical spine was the most common neck-related disability among both enlisted and officers. Paralysis of all radicular groups was followed by paralysis, upper radicular, 5th and 6th cervicals (n=253 were the second and third most frequently diagnosed neck conditions among both enlisted and officers) (Table 7).

**Table 7. Disabilities for Conditions Affecting the Neck for Army Enlisted and Officers.**

| **Disability Diagnosis of the Neck (VASRD code)** | **Enlisted** | | **Officer** | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Ankylosis of Cervical Spine (5287) | 33 | 2.9% | 2 | 2.1% |
| Limitation of Motion of Cervical Spine (5290) | 350 | 31.1% | 32 | 34.0% |
| Spinal Muscles: Erector Spinae (5320) | 7 | 0.6% | 3 | 3.2% |
| Lateral, Supra & Infrahyoid Muscles (5322) – SPELLING “INFRAHYOID”? | 5 | 0.4% | 0 | 0 |
| Lateral and Posterior Muscles of the Neck (5323) | 37 | 3.3% | 1 | 1.1% |
| Paralysis, Upper Radicular, 5th and 6th Cervicals (8510) | 238 | 21.2% | 15 | 16.0% |
| Paralysis of all Radicular Groups (8513) | 350 | 31.1% | 30 | 31.9% |
| Neuritis of Upper Radicular, 5$^{th}$ and 6$^{th}$ Cervicals (8610) | 19 | 1.7% | 2 | 2.1% |
| Neuritis of All Radicular Groups (8613) | 8 | 0.7% | 1 | 1.1% |
| Neuralgia of Upper Radicular Groups (8710) | 33 | 2.9% | 2 | 2.1% |
| Neuralgia of All Radicular Groups (8713) | 44 | 3.9% | 6 | 6.4% |
| **Total** | **1,124** | **~100%** | **94** | **~100%** |

There were 14,372 back-related disabilities reported during the study period. Table 8 displays specific VASRD back-related disabilities in the study population. The leading back-related disability code for enlisted was lumbosacral strain, accounting for nearly two-thirds of all back-related disability conditions. For officers the leading cause of back-related disability was intervertebral disc syndrome (44.4%), followed by lumbosacral strain (42%) (Table 8).

**Table 8. Disabilities for Conditions Affecting the Back for Army Enlisted and Officers.**

| Disability Diagnosis of the Back | Enlisted | | Officer | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Fracture of vertebra | 680 | 5.0% | 34 | 4.8% |
| Ankylosis of the spine | 141 | 1.0% | 15 | 2.1% |
| Limitation of motion of the spine | 587 | 4.3% | 37 | 5.3% |
| Intervertebral disc syndrome | 3,319 | 24.3% | 312 | 44.4% |
| Sacro-iliac injury and weakness | 156 | 1.1% | 6 | 0.9% |
| Lumbosacral strain | 8,762 | 64.1% | 296 | 42.1% |
| Pelvic girdle group 1 | 16 | 0.1% | 0 | 0 |
| Spinal Muscles | 8 | >.1% | 3 | 0.4% |
| **Total** | **13,669** | **~100%** | **703** | **~100%** |

## STANDARDIZED MORBIDITY RATIOS FOR NECK AND BACK INJURIES AND CONDITIONS

Table 9 summarizes the SMRs for neck and back injuries for Army officers by CMFs (i.e., inpatient hospitalizations, disability evaluations, accident reports, and outpatient visits). Missing SMRs indicate that there were too few outcomes among the cohort during the observation period for reliable estimation of the SMR. Less than 40% of the SMRs for officer CMF groupings reached statistical significance. Confidence Intervals for the reported SMRs in all tables are listed in Appendix A.

Among the officer population, Intelligence Officers, Engineering and Maintenance Officers, and Administrators appear to be at increased risk for minor neck and back problems, as reflected by a greater use of outpatient care for acute and chronic conditions. General/Executive officers have a notably higher risk of chronic back conditions that are treated in an inpatient setting (SMR=1.56, 95% CI: 1.18 - 2.03), while outpatient visits for chronic back conditions show the opposite pattern (SMR-0.72, 95% CI: 0.66 – 0.80).

Tactical Operations Officers, Non-Occupational Officers, and Scientists and Professionals appear to be at lower overall risk for neck- or back-related acute injury or chronic conditions. Among these four CMFs, healthcare utilization for chronic neck and back conditions is generally lower than that of the Army as a whole. The SMR for usage of inpatient facilities for chronic neck conditions among Scientists and Professionals was 0.62 (95% CI: 0.48 – 0.79); the SMR for back-related disabilities was 0.41 (95% CI: 0.26 – 0.63). Non-Occupational Officers also exhibited lower risk for neck and back-related injury and chronic conditions. Significantly low SMRs across all outcomes indicate that non-occupational officers have a lower rate of healthcare utilization in both inpatient and outpatient settings for both chronic and acute conditions affecting the neck and back than do Army officers at large. The SMR for outpatient visits for chronic neck conditions (SMR=0.64 95% CI: 0.61, 0.67) was significantly lower than that of other CMF groups. The SMR for discharges for chronic back disabilities was also significantly lower (SMR=0.50 95% CI: 0.38 – 0.65). This trend was consistent with accident rates reported by the Army Safety Center as well. The SMR for safety reports describing neck injury was significantly lower than that of the Army officers at large (SMR=0.53 95% CI: 0.29 – 0.88) (Table 9).

## Table 9. SMRs for Neck and Back Problems, Active Duty Army Officers.

| CMF | Inpatient Hospitalizations* | | | | Disability Evaluations* | | Safety Center Accident Reports* | | Outpatient Visits** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Back Acute | Back Chronic | Neck Acute | Neck Chronic | Back Chronic | Neck Chronic | Back Acute | Neck Acute | Back Acute | Back Chronic | Neck Acute | Neck Chronic |
| General/Executive Officers | - | **1.56** | - | 1.34 | - | - | - | - | 1.16 | ***0.72*** | 0.89 | 1.12 |
| Tactical Operations Officers | 0.91 | 0.98 | 1.14 | 0.97 | **1.14** | 1.02 | **1.30** | **1.37** | ***0.83*** | ***0.92*** | ***0.77*** | ***0.91*** |
| Intelligence Officers | 0.55 | 0.95 | 0.83 | 1.20 | 1.11 | 1.11 | 0.76 | 0.44 | **1.15** | **1.14** | **1.27** | **1.10** |
| Engineering & Maintenance Officers | 0.91 | **1.11** | 0.95 | 1.16 | **1.42** | 0.95 | 0.86 | 0.98 | **1.21** | **1.26** | **1.11** | 1.01 |
| Scientists and Professionals | 0.88 | ***0.87*** | 0.95 | ***0.62*** | ***0.41*** | 0.64 | 0.77 | 0.57 | 0.94 | ***0.97*** | 1.07 | **0.94** |
| Health Care Officers | 1.19 | **1.13** | 1.33 | **1.26** | 0.99 | 1.47 | 0.99 | 0.94 | **1.05** | ***0.96*** | **1.23** | **1.27** |
| Administrators | **1.51** | 0.94 | ***0.39*** | 0.83 | 0.98 | 0.78 | 0.90 | 0.62 | **1.36** | **1.17** | **1.30** | **1.14** |
| Supply, Procurement and Allied Officers | 1.21 | 1.03 | 0.79 | 1.04 | 1.13 | 0.70 | 0.96 | 1.30 | **1.19** | **1.06** | 1.00 | ***0.89*** |
| Non-occupational Officers | 0.94 | ***0.85*** | 0.85 | ***0.71*** | ***0.50*** | 0.93 | ***0.67*** | ***0.53*** | ***0.75*** | ***0.81*** | ***0.75*** | ***0.64*** |
| Unknown | - | 0.85 | 1.84 | 1.12 | - | - | - | - | 0.90 | ***0.88*** | 1.19 | ***0.79*** |

*1980-2002

**1998-2002

SMRs shown in bold red are significantly high at the 0.05 level; SMRs in bold green are significantly low at the 0.05 level. For black and white reports, shaded SMRs are significantly high and italicized SMRs are significantly low. Missing SMRs indicate that there were too few outcomes within the subgroup to allow reliable estimation of the SMR

Table 10 describes SMR for enlisted occupations. In comparison to the officer data, the SMR analysis of the enlisted CMF cohorts produced more robust statistical comparisons, due to greater population counts and more frequent outcomes within each CMF. Over 70% of the SMRs comparing enlisted CMF groups reached statistical significance. The additional statistical power also resulted in tighter confidence intervals around the SMRs. Among enlisted Soldiers, Health Care Workers, Support/Admin, Electrical/Mechanical Equipment Repair, Craftsworkers, and Service/Supply Soldiers were at greater risk for outpatient treatment of acute and chronic neck and back conditions. Though Administrators showed a greater rate of recorded outpatient encounters, their hospitalization rates, disability boards, and safety reported accidents were statistically lower than the enlisted Army as a whole. Health Care Workers experienced greater utilization of inpatient services as well as outpatient visits, but their risk of neck- or back-related accidents reportable to the Safety Center was not significantly elevated, nor was there greater relative risk of disability.

Craftsworkers (e.g., plumbers, electricians) appear to be at greater risk for disability and acute injury (reported to the Safety Center). The SMR for chronic neck disabilities among Craftsworkers was 1.45 (95% CI: 1.05 – 1.95); the SMR for acute neck injuries reported to the U.S. Army Safety Center for Craftsworkers was 1.30 (95% CI: 1.05 – 1.58). Soldiers in Services and Supply occupations are also at greater risk for reportable neck-related accidents. The SMR for neck-related accidents reported to the Safety Center for Service and Supply CMFs was 1.38 (95% CI: 1.27 – 1.50). Infantry/Gun crews appear to be at increased risk for more serious neck- and back-related injuries and conditions, as evidenced by increased risk for acute neck and back-related inpatient hospitalizations, accidents, and disabilities and lower risk for outpatient treatment for these same conditions. Electronic Equipment Repair, Communication, Intelligence, and Technical/Allied Specialists were at lower risk for inpatient and outpatient healthcare usage for neck and back conditions than the Army at large (Table 10).

## Table 10. SMRs for Neck and Back Problems, Active Duty Army Enlisted Soldiers.

| CMF | Inpatient Hospitalizations* | | | | Disability Evaluations* | | Safety Center Accident Reports* | | Outpatient Visits** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Back Acute | Back Chronic | Neck Acute | Neck Chronic | Back Chronic | Neck Chronic | Back Acute | Neck Acute | Back Acute | Back Chronic | Neck Acute | Neck Chronic |
| Infantry/Gun Crews | **1.10** | 1.01 | **1.24** | 1.03 | **1.16** | **1.29** | **1.30** | **1.11** | ***0.72*** | ***0.72*** | ***0.69*** | ***0.84*** |
| Electronic Equipment Repair | ***0.70*** | ***0.86*** | ***0.81*** | 0.98 | 0.95 | 0.84 | ***0.79*** | ***0.73*** | ***0.95*** | **1.11** | 0.97 | ***0.96*** |
| Communication and Intelligence | 0.93 | 0.98 | 0.99 | 0.92 | ***0.90*** | ***0.78*** | ***0.86*** | 0.91 | ***0.86*** | ***0.92*** | ***0.85*** | ***0.94*** |
| Health Care | **1.32** | **1.09** | 0.98 | **1.23** | ***0.91*** | ***0.77*** | 0.96 | ***0.81*** | **1.29** | **1.17** | **1.48** | **1.37** |
| Technical/Allied Specialist | ***0.66*** | ***0.84*** | ***0.70*** | 1.00 | ***0.79*** | 0.95 | ***0.82*** | 0.80 | 0.98 | ***0.99*** | **1.06** | ***0.91*** |
| Support / Administration | ***0.92*** | ***0.91*** | ***0.75*** | ***0.92*** | ***0.83*** | ***0.81*** | ***0.65*** | ***0.87*** | **1.12** | **1.15** | **1.20** | **1.02** |
| Electrical/Mechanical Equipment Repair | ***0.89*** | **1.09** | 0.94 | 1.03 | **1.08** | 1.08 | 1.02 | 0.93 | **1.10** | **1.10** | 1.01 | **1.03** |
| Craftsworkers | 0.85 | **1.14** | 1.16 | 0.99 | **1.24** | **1.45** | **1.23** | **1.30** | **1.24** | **1.22** | **1.19** | **1.23** |
| Service/Supply | **1.14** | **1.06** | 1.06 | 1.02 | 1.03 | 1.02 | **1.09** | **1.38** | **1.27** | **1.12** | **1.16** | **1.07** |
| Non-occupational | 1.20 | ***0.69*** | ***0.37*** | 0.29 | ***0.59*** | 0.21 | ***0.58*** | ***0.31*** | ***0.32*** | ***0.74*** | ***0.45*** | ***0.75*** |
| Unknown | 1.33 | 0.82 | ***0.19*** | 0.58 | ***0.36*** | 0.63 | ***0.24*** | - | ***0.43*** | ***0.48*** | ***0.46*** | ***0.69*** |

*1980-2002

**1998-2002

SMRs shown in bold red are significantly high at the 0.05 level; SMRs in bold green are significantly low at the 0.05 level. For black and white reports, shaded SMRs are significantly high and italicized SMRs are significantly low. Missing SMRs indicate that there were too few outcomes within the subgroup during the observation period.

Table 11 displays SMRs for male enlisted Soldiers in the twelve most populated MOSs. In general, use of ambulatory care clinics by the combat MOS was shown to be significantly lower than for males in other MOSs in the Army at large. Male Infantry Soldiers are at particular risk for serious neck- and back-related problems evidenced by significantly higher rates of neck- or back-related acute and chronic hospitalizations, neck- and back-related medical discharges (disabilities), and acute neck- and back-related accidents than any other male MOS studied. They are substantially less likely to be seen in ambulatory care clinics for acute or chronic neck or back problems.

Medical Specialists are also at increased risk for all neck- and back-related hospitalizations, as well as accidents. They are at small magnitude, but statistically significantly increased risk for outpatient treatment of a chronic neck-related disorder, but at significantly lower risk for outpatient care of an acute or chronic back-related problem. These findings suggest that among Infantrymen and perhaps Medical Specialists, neck and back injuries, when they do occur, are more serious.

Canon Crewmembers are at increased risk for hospitalization to treat acute neck and back problems, but not at increased risk for hospitalizations to treat chronic neck or back disorders or medical discharges.

Military Police are at increased risk for hospitalization to treat chronic neck- and back-related disorders, but at significantly lower risk for medical discharge due to chronic back-related disorders. In contrast, Fighting Vehicle Infantrymen were at significantly lower risk for a hospitalization to treat an acute back-related disorder, but at significantly greater risk for a back-related medical discharge from the Army.

Food service specialists are at increased risk for acute and chronic back-related hospitalizations, and Unit Supply Specialists appear to be only at increased risk for acute back-injury hospitalizations.

## Table 11. SMRs for Neck and Back Injury, Twelve Largest Army Male Enlisted Military Occupational Specialties.

| Top 12 MALE MOS Groups | Inpatient Hospitalizations* | | | | Disability Evaluations* | | Safety Center Accident Reports* | | Outpatient Visits ** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Back Acute | Back Chronic | Neck Acute | Neck Chronic | Back Chronic | Neck Chronic | Back Acute | Neck Acute | Back Acute | Back Chronic | Neck Acute | Neck Chronic |
| 11B Infantryman | **1.26** | **1.11** | **1.46** | **1.19** | **1.67** | **1.59** | **1.69** | **1.18** | ***0.79*** | ***0.70*** | ***0.82*** | ***0.89*** |
| 13B Canon Crewmember | **1.44** | 0.98 | **1.18** | 0.86 | 1.00 | 0.92 | 1.07 | 0.89 | ***0.84*** | ***0.85*** | ***0.69*** | ***0.84*** |
| 95B Military Police | 0.99 | **1.08** | 0.94 | **1.34** | ***0.77*** | 0.95 | **1.28** | **1.77** | ***0.83*** | ***0.92*** | ***0.83*** | ***0.90*** |
| 63B Light Wheeled Mechanic | 0.93 | **1.13** | 0.91 | 1.09 | 0.98 | 1.05 | ***0.82*** | ***0.72*** | **1.20** | **1.16** | 0.97 | 1.02 |
| 94B Food Service Specialist | **1.26** | **1.13** | 1.14 | ***0.81*** | ***0.64*** | 0.87 | 0.83 | 0.80 | 0.49 | ***0.41*** | - | 1.08 |
| 12B Combat Engineer | 0.98 | 1.08 | **1.28** | 1.24 | **1.17** | 1.21 | **1.39** | **1.34** | ***0.89*** | ***0.90*** | ***0.65*** | ***0.88*** |
| 76Y Unit Supply Specialist | **1.51** | 1.05 | 1.02 | 0.91 | ***0.67*** | 1.08 | 0.82 | 0.91 | - | ***0.42*** | - | 0.66 |
| 91A/B Medical Specialist | **1.56** | **1.21** | **1.61** | **1.37** | 1.05 | 0.94 | **1.37** | **1.27** | ***0.89*** | ***0.88*** | 1.02 | **1.05** |
| 71L Administrative Specialist | 0.93 | 1.05 | ***0.54*** | ***0.77*** | ***0.70*** | 1.15 | ***0.54*** | ***0.69*** | 1.00 | **1.06** | 0.95 | ***0.86*** |
| 19K Armor Crewman | 0.80 | ***0.84*** | 0.97 | ***0.68*** | **1.13** | 1.37 | **1.22** | **1.36** | ***0.61*** | ***0.67*** | ***0.62*** | ***0.82*** |
| 19D Cavalry Scout | 0.77 | ***0.88*** | 0.99 | 0.88 | 1.03 | 0.94 | 0.88 | 1.18 | ***0.69*** | ***0.73*** | ***0.81*** | ***0.91*** |
| 11M Fighting Vehicle Infantryman | ***0.50*** | ***0.84*** | 1.07 | 0.82 | **1.46** | 1.39 | 0.95 | **1.48** | ***0.47*** | ***0.56*** | ***0.45*** | ***0.71*** |

*1980-2002

**1998-2002

SMRs shown in bold red are significantly high at the 0.05 level; SMRs in bold green are significantly low at the 0.05 level. For black and white reports, shaded SMRs are significantly high and italicized SMRs are significantly low. Missing SMRs indicate that there were too few outcomes within the subgroup during the observation period.

Table 12 shows SMR analysis of the twelve most populated female occupational groups. The SMR analyses of the enlisted male MOS cohorts produced more stable statistical comparisons than for the female MOS cohorts (60% reached significance vs. 50% for female MOS groups), due to the large population sizes and correspondingly higher numbers of outcomes within each MOS subgroup.

Enlisted women in virtually all of the most common MOSs were at increased risk for neck- and back-related outpatient visits except Unit Supply Specialists (too few for statistical comparison) and Food Service Specialists, who were at increased risk for outpatient treatment of chronic neck-related disorders, but not for chronic back-related problems or acute neck- or back-related injuries.

Medical Specialists, Unit Supply Specialists, and Licensed Practical Nurses were all at increased risk for hospitalization to treat an acute back-related injury. Military Police and License Practical Nurses were also at greater risk for hospitalization to treat a chronic back-related disorder, a pattern also observed among male Licensed Practical Nurses. Enlisted women in Military Police MOSs were also at increased risk for hospitalization to treat chronic neck-related disorders.

Eight of the 12 largest female MOS groups had significantly increased risk for disability discharge, particularly among Petroleum Supply Specialists, Motor Transport Operators, and Automated Logistics Specialists.

Only female enlisted Soldiers in Military Police MOSs were at increased risk for a neck- or back-related accident reported to the Safety Center.

Administrative specialists were at significantly lower risk for all injury- and back-related hospitalizations than the general enlisted population, and were also at lower risk for chronic back-related disability discharge and acute back-related accidents reportable to the Safety Center.

Unit Service and Supply Specialists, though at increased risk for acute back-related injury hospitalizations, were at significantly *lower* risk for back-related disability discharge.

## Table 12. SMRs for Neck and Back Injury, Twelve Largest Army Female Enlisted Military Occupational Specialties.

| Top 12 FEMALE MOS Groups | Inpatient Hospitalizations* | | | | Disability Evaluations* | | Safety Center Accident Reports* | | Outpatient Visits** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Back Acute | Back Chronic | Neck Acute | Neck Chronic | Back Chronic | Neck Chronic | Back Acute | Neck Acute | Back Acute | Back Chronic | Neck Acute | Neck Chronic |
| 71L Administrative Specialist | ***0.72*** | ***0.82*** | ***0.64*** | ***0.71*** | ***0.77*** | 0.98 | ***0.59*** | 0.81 | **1.49** | **1.49** | **1.79** | **1.58** |
| 91A/B Medical Specialist | **1.61** | 1.03 | 1.08 | 1.18 | **1.28** | 0.65 | 0.94 | 0.96 | **1.49** | **1.43** | **2.11** | **2.24** |
| 76Y*** Unit Supply Specialist | **1.59** | 1.10 | 0.75 | 0.51 | ***0.46*** | 0.41 | 0.70 | 0.92 | - | - | - | - |
| 94B Food Service Specialist | 1.52 | 1.07 | 1.11 | 0.68 | 0.79 | 0.61 | ***0.58*** | 1.15 | 1.56 | 0.97 | 3.36 | **4.76** |
| 95B Military Police | 0.78 | **1.32** | 0.85 | **1.90** | **1.84** | 1.26 | **1.49** | **2.61** | **1.68** | **1.83** | **1.79** | **2.01** |
| 75B Personnel Administration | 1.26 | ***0.74*** | 0.93 | 0.95 | **1.39** | 1.65 | ***0.32*** | 1.01 | **1.67** | **1.78** | **1.61** | 1.08 |
| 91C Licensed Practical Nurse | **3.19** | **1.90** | 1.65 | 0.74 | 1.30 | 1.91 | 1.44 | 1.07 | **1.89** | **1.69** | **3.11** | **2.20** |
| 63B Light Wheeled Mechanic | 1.26 | 1.02 | 1.22 | 0.65 | **2.11** | 1.89 | 1.25 | 1.52 | **2.08** | **1.90** | **1.83** | **1.88** |
| 88M Motor Transport Operator | 0.59 | ***0.76*** | 0.78 | 0.81 | **2.37** | 1.24 | 1.26 | 1.20 | **2.29** | **1.84** | **2.11** | **1.98** |
| 92A Automated Logistics Specialist | ***0.39*** | ***0.58*** | 0.47 | 1.32 | **2.32** | 1.19 | 0.76 | 1.53 | **1.57** | **1.73** | **1.83** | **1.63** |
| 92Y Unit Supply Specialist | ***0.10*** | ***0.38*** | ***0.30*** | 0.78 | **1.95** | 1.37 | 0.71 | 1.20 | **1.56** | **1.66** | **1.87** | **1.84** |
| 77F Petroleum Supply Specialist | 1.52 | 0.82 | 1.13 | 0.51 | **2.45** | 0.77 | 1.35 | 1.41 | **1.67** | **1.82** | **1.55** | **1.67** |

*1980-2002
**1998-2002
***76Y later became 92Y
SMRs shown in bold red are significantly high at the 0.05 level; SMRs in bold green are significantly low at the 0.05 level. For black and white reports, shaded SMRs are significantly high and italicized SMRs are significantly low. Missing SMRs indicate that there were too few outcomes within the subgroup during the observation period.

Table 13 shows SMRs for officers based on hazardous duty exposure. Officers who received any hazardous duty pay, with the exception of special pay for demolition duty, experienced significantly greater risk of an accident resulting in back injury. The SMR risk for acute back injury reported in the Safety Center data for officers receiving flight pay was 1.69 (95% CI = 1.63 – 2.97), and for parachuting pay was 2.23 (95% CI = 1.38 – 2.05). The SMR for officers receiving special pay for both parachuting and flying was 3.80 (95% CI: 1.96 - 6.64).

Though receipt of hazardous duty pay for parachuting was associated with increased risk for an accident causing a back injury, it was associated with lower risk of acute or chronic back-related hospitalization and outpatient visits, lower risk for outpatient treatment of neck injury, and lower risk for neck or back-related disability discharge. Similarly, Soldiers with the greatest exposure to hazards (top $10^{th}$ and $20^{th}$ percentiles) were at significantly lower risk for hospitalization to treat an acute or chronic back-related disorder.

Officers who received special pay for exposure to flying were at significantly greater risk of chronic back- and neck-related inpatient hospitalization and outpatient treatment for these conditions, as well as back-related disability discharge and back-related accidents.

Soldiers receiving special pay for demolition duty appear to be at significantly greater risk of *minor* neck and back injury, as evidenced by greater use of outpatient facilities for these conditions. They may also be at increased risk for chronic neck-related hospitalizations, though the sample size was not large enough to achieve statistical significance (Table 13).

## Table 13. Hazardous Duty Pay and SMR for Army Officers by Health Outcome.

| HAZARDOUS DUTY PAY – For Officers | Inpatient Hospitalizations* | | | | Disability Evaluations* | | Safety Center Accident Reports* | | Outpatient Visits ** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Back Acute | Back Chronic | Neck Acute | Neck Chronic | Back Chronic | Neck Chronic | Back Acute | Neck Acute | Back Acute | Back Chronic | Neck Acute | Neck Chronic |
| Parachute Pay | ***0.65*** | ***0.71*** | 1.08 | 0.93 | ***0.79*** | ***0.22*** | **1.55** | 1.16 | ***0.89*** | ***0.84*** | ***0.87*** | ***0.96*** |
| Flight Pay | 0.61 | **1.25** | 0.51 | **1.46** | **1.49** | 1.85 | **1.94** | 1.55 | ***0.89*** | **1.25** | 0.94 | **1.07** |
| Parachute and Flight Pay | 0.39 | 0.97 | 1.00 | 1.49 | 1.04 | 1.16 | **2.84** | 1.66 | ***0.59*** | ***0.51*** | 0.84 | 0.94 |
| Demolition Pay | - | 0.58 | - | 1.89 | 0.88 | - | 0.43 | - | **1.93** | **1.21** | **1.60** | **1.61** |
| Top 10th percentile | ***0.25*** | ***0.87*** | 0.69 | 1.06 | 0.82 | 0.68 | **2.27** | 1.72 | ***0.77*** | 0.98 | 0.94 | **1.06** |
| Top 20th percentile | ***0.39*** | ***0.86*** | 0.88 | 1.19 | 0.96 | 0.82 | **2.08** | 1.39 | ***0.86*** | 1.01 | 0.90 | 0.99 |

*1980-2002

**1998-2002

SMRs shown in bold red are significantly high at the 0.05 level; SMRs in bold green are significantly low at the 0.05 level. For black and white reports, shaded SMRs are significantly high and italicized SMRs are significantly low. Missing SMRs indicate that there were too few outcomes within the subgroup during the observation period.

Table 14 shows associations between hazardous duty pay and risk for back and neck injury among enlisted Soldiers. Despite concerns about exposure to flying and possible links to neck problems due to head-supported mass, enlisted Soldiers drawing hazardous duty pay in all areas but parachuting were at lower risk of back-related disability. Risk for inpatient or outpatient visits for acute and chronic back conditions was generally significantly low for all groups performing hazardous duty as well (Table 14).

As with officers, enlisted Soldiers receiving any type of hazardous duty pay, with the exception of demolition pay, were at increased risk for an acute back-related accident. Enlisted receiving special pay for demolition duty were at significantly lower risk of outpatient care for neck or back problems, but at significantly increased risk for hospitalization for a chronic neck-related problem.

The risk profile of Soldiers in the top $10^{th}$ and $20^{th}$ percentile exposure groups is very similar to those receiving special pay for parachuting and flight time. Parachute is the largest and flight pay is the second largest category of hazardous duty pay for enlisted who receive special pay, with over half of the enlisted who receive special pay for flight also receiving special pay for parachuting. Seventy-six percent of the long-term hazardous duty performers are parachutists. Thus, the top $20^{th}$ percentile of exposed enlisted is probably largely comprised of Soldiers who parachute and fly frequently. Chronic neck and acute back injury accidents plague all these groups, but only those receiving parachute pay are also at increased risk of back and neck-related disability.

Enlisted Soldiers receiving hazardous duty pay for parachuting were at increased risk for acute neck-related outpatient care and hospitalization for chronic neck problem. They were also at increased risk for a back-related accident and both back- and neck-related disability discharge. This contrasts to officers receiving parachute pay who were only at increased risk for a back-related accident.

## Table 14. Hazardous Duty Pay and SMR for Enlisted Soldiers by Health Outcome.

| HAZARDOUS DUTY PAY – For Enlisted | Inpatient Hospitalizations* | | | | Disability Evaluations* | | Safety Center Accident Reports* | | Outpatient Visits ** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Back Acute | Back Chronic | Neck Acute | Neck Chronic | Back Chronic | Neck Chronic | Back Acute | Neck Acute | Back Acute | Back Chronic | Neck Acute | Neck Chronic |
| Parachute Pay | ***0.67*** | ***0.84*** | 1.03 | **1.30** | **1.06** | **1.21** | **1.73** | 1.09 | ***0.88*** | ***0.72*** | **1.11** | ***0.95*** |
| Flight Pay | ***0.71*** | 0.93 | ***0.61*** | **1.27** | ***0.63*** | 0.60 | **1.23** | 1.02 | ***0.75*** | ***0.71*** | 0.97 | ***0.93*** |
| Parachute and Flight Pay | 0.72 | 0.98 | 0.51 | 1.26 | ***0.50*** | 1.08 | **1.70** | 1.19 | ***0.76*** | ***0.54*** | 0.88 | ***0.50*** |
| Demolition Pay | 0.55 | ***0.70*** | 1.02 | **1.77** | ***0.51*** | 0.41 | 0.94 | 1.29 | ***0.75*** | ***0.75*** | ***0.80*** | 0.92 |
| Top 10th percentile | ***0.55*** | ***0.62*** | ***0.75*** | 1.10 | ***0.32*** | ***0.39*** | **1.69** | 0.93 | ***0.63*** | ***0.48*** | ***0.67*** | ***0.66*** |
| Top 20th percentile | ***0.59*** | ***0.66*** | ***0.76*** | **1.22** | ***0.47*** | ***0.72*** | **1.59** | 0.97 | ***0.71*** | ***0.56*** | ***0.84*** | ***0.72*** |

*1980-2002

**1998-2002

SMRs shown in bold red are significantly high at the 0.05 level; SMRs in bold green are significantly low at the 0.05 level. For black and white reports, shaded SMRs are significantly high and italicized SMRs are significantly low. Missing SMRs indicate that there were too few outcomes within the subgroup during the observation period.

## DISCUSSION

Neck and back injuries exact a significant human and economic toll on the health and readiness of the U.S. Army. Recent technological advances have brought useful tools to Soldiers, such as weapon sighting systems and night vision goggles. However, these devices increase the weight a Soldier must support on his or her head and neck. There has been increasing concern, anecdotal reports, and some preliminary findings from case series analysis and small epidemiological studies suggesting that the use of such devices may elevate the risk of neck and back problems. Despite these concerns, there have been few population-based studies to document the incidence of such injuries, and even fewer attempts to identify the occupational subgroups of Soldiers at particular risk.

More than 1,250,000 medical outcomes were examined in this study. Moreover, morbidity outcomes were assessed for numerous key subpopulations including officers and enlisted servicemembers encompassing ten Career Management Fields for officers and eleven for enlisted servicemembers, twelve individual occupational groups for enlisted men and women, and six hazardous duty exposure groups each for officers and enlisted servicemembers. Our findings demonstrate that certain occupational subgroups are at increased risk of neck- and back-related problems and deserve additional follow-up to further characterize their risks.

These data highlight patterns of risk sufficiently concerning to suggest the development of interventions for the subgroups at greatest risk. However, because analyses rely on secondary data sources, it was not possible to determine whether specific occupational exposures, such as increased head load-bearing or other factors, explain the increased risk. Future studies should include in-depth ergonomic, safety, and medical assessments of individuals in higher risk occupations. We believe additional multivariate analyses are also called for.

While we cannot directly measure specific risk exposures, we can speculate about specific exposures, based on patterns of injury across occupational specialties. For example, male enlisted Soldiers in 11B infantry positions are at increased risk for acute and chronic neck problems, while other Soldiers in fighting specialties, such as fighting vehicle infantryman, cannon crewmember, and cavalry scout, are not. Infantry Soldiers perform a great deal of marching with packs and gear and may be required to jump or climb in and out of vehicles under the weight of such equipment. Many are also in active airborne positions. The physical demands of these jobs may increase risk for neck injury. The increased risk of neck and back injury could also be the result of exposures to whole-body vibrations, such as those that occur while riding in a transport vehicle. Risk of neck and back injury may also be related to the availability of vehicle safety systems. Five ton trucks may not have passenger restraints, such as provided in Bradley Fighting Vehicles, HUMMVs, and other tactical vehicles. Troop movement vehicles do not generally have safety belts available at every seating position. By contrast, infantrymen in other MOSs, such as fighting vehicle infantryman or cavalry scout, would more likely have access to safety belts.

Enlisted Soldiers receiving hazardous duty pay for parachuting were at increased risk for acute neck-related outpatient care and hospitalization for chronic neck problem. They were also at increased risk for a back-related accident and both back- and neck-related disability discharge. This contrasts to officers receiving parachute pay who were only at increased risk for a back-related accident. This may be due, in part, to imprecision of the hazardous duty pay variable, which can only capture exposure per se and not fully assess the extensiveness of the exposure. It may be that officers receiving hazardous duty pay for parachuting parachute less frequently than enlisted jumpers. It may also be that the types of jumps performed by enlisted differ from officers (e.g. more equipment carried) resulting in different health outcomes.

As with officers, enlisted Soldiers receiving any type of hazardous duty pay, with the exception of demolition pay, were at increased risk for an acute back-related accident. Enlisted receiving special pay for demolition duty were at significantly lower risk of outpatient care for neck or back problems, but at significantly increased risk for hospitalization for a chronic neck-related problem. This, along with potential increased risk of chronic neck-related hospitalizations seen with officers, indicates the need for more study of potential neck-injury risk facing Soldiers exposed to occupational hazards.

Infantry/Gun crews are also at greater risk for acute and chronic neck-related problems that result in an inpatient hospitalization, as well as neck-related accidents and disabilities. They are at lower risk for outpatient treatment for neck-related problems, suggesting that when they do experience a neck or back injury, theirs may be more serious and life changing or disabling. On the other hand, they seem to be at lower risk for the more minor neck-related injuries and conditions. The specific nature of their disabilities was not evaluated in these analyses. For example, we do not know the extent of long-term dysfunction or disability, nor whether the disability arises from an incapacitating injury, or chronic overuse resulting in a debilitating condition. More research is needed to understand the nature of disability, as well as the etiology in this population.

While increased risk for neck and back injury among pilots may suggest a link between head-supported mass and risk of injury, our work documents increased risks of neck and back-related conditions in a diverse range of occupational subspecialties, suggesting that the increased availability of head-supported devices is not likely to explain all such morbidity. For example, our findings show that female and male enlisted Soldiers in nursing or similar health support positions (e.g., medics) are at increased risk for back-related problems. While Soldiers in these occupations are generally not required to wear heavy equipment on their head, they may in the course of their work be required to do heavy lifting in order to transport patients, or they may have to sit in unsupported or bent positions in order to perform medical procedures, which could put additional strain on their neck and back. This is similar to what has been documented among health care workers in civilian studies(9, 24, 25).

It is important to consider some of the strengths and limitations of this study when interpreting the key findings. SMR analysis, as a method of comparing morbidity

across various groups of individuals, has several strengths and weaknesses. SMRs are useful for comparing rates in different populations and, in this case, allow us to estimate the relative risk for back and neck injury in a subgroup as compared to the population as a whole. Unfortunately, SMRs do not allow us to effectively control for multiple risk factors simultaneously. For example, we cannot determine with this SMR approach *how much* the elevated risk of injury faced by infantry Soldiers might be explained by increased exposure to parachuting.

Similarly, we cannot control for all potential confounders and potential biases such as survivor bias. In order to be in the top 10% or 20% of individuals drawing hazardous duty pay over a given time period, one must be a survivor. In other words, only the most experienced jumpers, perhaps the most skilled jumpers, will make it into this subgroup. These individuals will also likely be older, of higher rank, of better general health, and perhaps of greater military career aspiration than those who jump infrequently. If parachuting does indeed cause neck and back problems, we would expect this group to nonetheless exhibit higher risk of injury. However, the magnitude of the difference may be pushed toward the null if none of these factors can be introduced or controlled in the analysis.

These analyses do not adjust for a number of demographic and lifestyle variables likely to be correlated both with occupational choice and risk for neck injury during leisure time. Our previous work shows that Soldiers in 11B infantry positions tend to be greater risk takers (6, 26). Because we are not directly measuring occupational exposures and injuries occurring on the job, it is possible excess injuries among 91B Soldiers may also be substantially influenced by off-duty activities.

We have defined neck and back injury and condition outcomes on the basis of primary diagnosis only. This will have resulted in undercounting some cases. However, we have no reason to believe that this would have been done disproportionately for the study group and the comparison population. Thus, we do not believe this limitation will result in any bias in the SMR comparisons.

Due to small sample sizes, we had little power for some of the hazardous duty pay analyses. Similarly, some of the twelve most common MOSs were reduced in size or eliminated during later years, and we were thus not able to analyze outpatient data on these groups, since the outpatient database is relatively new. These groups are 94B and 76Y for males and 76Y, 94B, and 75D for females.

Because these analyses employ data from administrative sources, we have little control over the quality of the data. For example, parachuting injuries may be more easily identified and captured within the Safety Data than other types of accidents, particularly those that are more likely to occur while off duty (e.g., motor vehicle crashes). Higher rates of reporting of parachuting accidents may explain why the SMRs for safety outcomes within the hazardous duty cohorts are so much higher than those in other cohorts.

The SMR analysis is, by design, a general approach to identifying health problems in a population. Few clear patterns emerge from this analysis to the extent that no group shows excess morbidity across all outcomes measured. Nonetheless, this analysis does identify a number of subgroups that appear to have excess morbidity, or are at particular risk for discrete types of outcomes. Additional study is now necessary to attempt to identify specific risk factors and to explore plausible links between morbidity and head-supported mass.

Each medical outcome considered in this study provides a very different window through which to view morbidity. This approach is valuable in that it provides a good bird's eye view of the problem in a general sense. The data in this report describe hundreds of subgroups of active duty Army Soldiers. In many instances, a group may seem to exhibit high risk for neck or back conditions for one outcome, only to exhibit a significantly lower risk in another. The causes of neck and back conditions are clearly multifactorial in nature. Of course, it is reasonable to expect that individuals at greatest risk of injury will make the most visits to outpatient clinics, will lose time from work resulting in the generation of an accident report to the safety center, will be more likely to be hospitalized for this condition, and ultimately, if the condition is severe enough, will be the most likely to be referred to a physical evaluation board.

On the other hand, there are a myriad of factors that may alter the odds of any given individual or group of individuals actually appearing in one of these databases. While some of these factors are speculative or unprovable, others are fairly well accepted. In any case, before the results presented here can be fully appreciated, some of these factors should be discussed. For example, individuals who draw hazardous duty pay for flying or parachuting may be more likely to have their lost time injuries reported to the safety center because aviation and airborne units tend to have stronger safety programs than other units. Indeed, many of these units have designated safety officers and NCOs whose main job role may be to monitor unit safety and track and report accidents when appropriate.

Infantry Soldiers, on the other hand, may be more likely to receive care outside the detection of the ambulatory care system. This is because infantry units still receive a substantial amount of routine care in Battalion Aid Stations that are often not part of the electronic reporting system. Thus, the low outpatient SMRs for the Infantry MOS and CMF may be nothing more than an artifact of their outpatient encounters not being recorded to the same degree as the comparison groups.

Independent of these factors is the possibility that certain individuals may be more or less likely to seek care for a given severity of illness or injury. Aviators perhaps avoid medical care in order to minimize a possible loss of flight status. Perhaps General officers avoid outpatient clinics because of time commitments or because of a greater ability to receive "house calls." Medical personnel may have greater access to care due simply to proximity to services and a greater understanding of how to enter and utilize the medical care system. Many other factors could be discussed or considered, though few of them could be proven. Thus the reader is advised that the most reasonable approach to making sense of the findings presented here is to perhaps

focus on a few subgroups that have either dramatic increases in risk in any given outcome, or consistent increases in risk across all or most outcomes categories.

It is also important to recognize the interrelationship between job physical demands, job satisfaction, and other psychosocial factors and risk for musculoskeletal disorders, such as back and neck-related problems(21). It is possible that some of the occupational associations we identify relate more to self-selection factors and/or psychosocial aspects of the job. Nonetheless, the identification of groups at risk suggests the need for more in-depth analyses and investigation. Whether the causes are due to increased head-supported mass, other environmental or occupational exposures, off-duty behaviors, psychosocial factors, or the combined synergistic effect of multiple risk factors, the end result is increased morbidity and mortality and increased costs.

There are efforts currently underway to develop a physical conditioning program to reduce the risk of such injuries. Intervention efforts such as these should be developed along with planned strategies for evaluating the efficacy of the intervention. In addition to trying to protect Soldiers by making them more resistant to harm caused by head-supported mass, it would be useful to pursue studies of the risk of head-supported mass that more directly measure exposures to head-loading and subsequent experiences with injuries.

## SUMMARY AND CONCLUSIONS

- Back and neck injury and conditions are a huge problem. Over a twenty year period (for hospital, disability, and accident reports) and a five year follow-up of outpatient visits, there were 1,257,878 back- or neck-related health encounters, with the vast majority of these (85%) due to back injury or conditions.

- Subgroups of Army Soldiers with excess risk of neck and back problems can be identified based on gender, rank, occupational subgroup, and exposure to hazardous duty. When a spectrum of outcomes are surveyed, few subgroups demonstrate equal risk profiles across all outcomes; some having greater risk of minor injury versus severe injury, and some demonstrating greater risk of chronic conditions versus acute injury.

- Comparison of morbidity risk across a spectrum of outcomes suggests factors other than actual medical risks may influence the rates observed for the various outcomes. Administrative factors such as presence of unit safety programs at aviation and airborne units, or the provision of ambulatory care at Battalion Aid Stations among field units, may partially explain this phenomenon.

- Rank is associated with risk of back and neck injury. Rates of neck injury-related hospitalization per person year were nearly three times higher for enlisted than for officers. However, officers were more likely to be treated for neck conditions in an outpatient setting, suggesting rank-related differences in disease etiology and exposures.

- While hazardous duty pay has been shown to correlate to increased injury risk(7), greater amounts of exposure, at least as measured by our proxy of top $10^{th}$ and $20^{th}$ percentile, do not necessarily equate to increased risk for neck or back injury. Parachuting was the single greatest source of hazardous duty exposure for both officers and enlisted, but comprised a greater proportion of the population at risk among enlisted than officers. Receipt of hazardous duty pay for parachute exposure among officers was associated with *lower* risk for acute back and neck hospitalizations, disabilities, and outpatient visits compared to the general population of officers, but increased risk for accidents reported to the Safety Center. Enlisted who received special pay for parachuting were also at significantly lower risk than the general enlisted population for acute or chronic back-related hospitalizations. However, they were at increased risk for chronic neck-related hospitalizations, acute neck outpatient visits, acute back injury accidents reported to the Safety Center, and increased risk for back- or neck-related disabilities.

- For officers, flight pay was a greater source of hazardous duty exposure than for enlisted. It was also the only hazardous duty category associated with increased risk for hospitalization among the officers. It was associated with increased risk for chronic neck and back hospitalizations, outpatient visits, back-related accident reports, and disabilities. Enlisted flight pay was associated with chronic neck-related hospitalizations and acute back injury accident reports, but lower risk for disability.

- Hospitalization might be viewed as an indicator of severity for back and neck injury. Though, as a whole, outpatient visits for back or neck conditions far out numbered hospitalizations, the ratio of outpatient to inpatient visits varied by diagnosis, with spondylosis and disc disorders among those conditions more likely to be reported from hospital settings, and the less specific conditions such as “pain” and segmental/somatic disorders more common in the outpatient setting. Even though hospitalizations may be viewed as more serious events than outpatient visits, outpatient treatment for neck and back problems may also result in long-term and costly treatment for neck and back conditions. For example, female motor transport, unit supply, and automated logistics specialists are all at lower risk than the general female enlisted population for back hospitalizations, but at increased risk for all back and neck outpatient visits AND at increased risk for chronic back-related disability. Thus, even less “severe” back-related problems (those treated in outpatient setting only) may result in long-term, chronic back problems and disability.

- Certain occupational subgroups appear to be particularly vulnerable to neck and back problems. Healthcare workers in enlisted and officer ranks are at increased risk for acute and chronic back and neck problems, as reflected by increased hospitalizations and outpatient visits. However, these health encounters do not necessarily translate into increased risk for disability, as these same occupational

subgroups are actually at lower risk for neck- and back-related disability. The reason for this is not clear. It may be that healthcare workers are more likely to seek treatment for injuries sooner and/or may follow-up with better self-care and physical therapy than Soldiers not in healthcare professions, and thus have better long-term outcomes. Or, the types of injuries healthcare workers experience may also be less likely to result in long-term disability. Or, they may simply be less likely to see disability evaluation for a given chronic neck or back problem than other Soldiers with these conditions.

- General officers and, to some degree, officers in administrative positions may be at increased risk for chronic neck and back problems. Since these occupational specialties are not generally rated as being physically demanding, and since general officer tend to be older than even our highest strata, the etiology of this association is unclear and warrants further investigation. Some of this association could also be an artifact of the study design which groups all officers over 40 in one broad category. Higher ranking officers are likely to be much older than 40 as compared to lower ranking officers. The age adjustment we make, because it is so broad, may not be fully accounting for this variation.

- Infantry Soldiers, as expected, are at increased risk for acute neck and back injuries resulting in hospitalizations, accidents and, ultimately, disabilities. They are at lower risk for outpatient visits related to neck or back problems, which might suggest that their neck and back injuries, when they do occur, are serious and related to trauma, as opposed to the neck and back problems encountered in other MOSs, where the injury may be the result of repetitive but more minor traumatic exposures. As previously mentioned, the use of Battalion Aid Stations by infantry units makes these comparisons more difficult.

- Food service workers appear to be at greater risk for back- but not neck-related problems, possibly due to the types of lifting and carrying tasks they undertake in their food preparation work.

- Male and female military police are at increased risk for chronic neck and back hospitalizations, but not acute hospital injury. However, only female military police are also at increased risk for back-related disabilities. Male military police are at lower risk. This is consistent with civilian studies, which have found generally poorer outcomes for women than male workers with initial back-related problems(11, 23).

- This study also points to the importance of subgroup analysis, as aggregation can hide important risk associations. For example, while the literature shows that medical care specialists, particularly nurses and orderlies, are at increased risk for back-related problems, and our aggregate data agree, the patterns differ by gender-specific specialties; female licensed practical nurses are at particular risk for acute and chronic back problems, and male 91A medical specialists (who also fall under the larger CMF heading of medical care) are at increased risk for

back and neck acute and chronic conditions. There are also possible gender differences in exposures even for individuals within the same MOS. Male 91A medical specialists were at increased risk for acute and chronic back and neck hospitalizations, while female 91A medical specialists are only at increased risk for acute back hospitalizations. Nonetheless, female medical specialists are at increased risk for back-related disability, while male medical specialists are not.

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# APPENDIX A:

# CONFIDENCE INTERVALS FOR STANDARD MORBIDITY RATIOS

**The following tables provide confidence intervals for all Standard Morbidity Ratios appearing in Tables 9-14 in the Results Section. High SMRs that are statistically significant are shown in red, while low SMRs are shown in green. For comparable view of this report in black and white, high SMRs also appear in shaded boxes, and low SMRs in italics. Note: Some significant confidence intervals appear to contain a value of "1.00." Where this occurs, it is due to rounding; the SMRs are nonetheless significant at the 0.05 level. Missing SMRs indicate that there were too few outcomes within the subgroup during the observation period.**

## Table 9 Components. SMRs for Neck and Back Problems, Active Duty Army Officers.

### Table 9A. Career Management Field and Inpatient Hospitalizations.

| CMF | Inpatient Hospitalizations, 1980-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Intervals | Back Chronic | Confidence Intervals | Neck Acute | Confidence Intervals | Neck Chronic | Confidence Intervals |
| General/ Executive Officers | - | - | 1.56 | 1.18-2.03 | - | - | 1.34 | 0.75- 2.21 |
| Tactical Operations Officers | 0.91 | 0.72-1.12 | 0.98 | 0.94-1.03 | 1.14 | 0.92-1.40 | 0.97 | 0.87-1.08 |
| Intelligence Officers | 0.55 | 0.24-1.09 | 0.95 | 0.84-1.07 | 0.83 | 0.38-1.58 | 1.20 | 0.95- 1.49 |
| Engineering & Maintenance Officers | 0.91 | 0.62-1.30 | 1.11 | 1.03- 1.19 | 0.95 | 0.61-1.42 | 1.16 | 1.0- 1.35 |
| Scientists and Professionals | 0.88 | 0.48-1.47 | *0.87* | *0.78-0.96* | 0.95 | 0.43-1.80 | *0.62* | *0.48-0.79* |
| Health Care Officers | 1.19 | 0.89-1.54 | 1.13 | 1.06- 1.20 | 1.33 | 0.97-1.80 | 1.26 | 1.12- 1.41 |
| Administrators | 1.51 | 1.05-2.11 | 0.94 | 0.85- 1.03 | *0.39* | *0.14-0.84* | 0.83 | 0.67-1.02 |
| Supply, Procurement and Allied Officers | 1.21 | 0.80-1.76 | 1.03 | 0.94- 1.13 | 0.79 | 0.42-1.35 | 1.04 | 0.86-1.26 |
| Non-occupational Officers | 0.94 | 0.65-1.32 | *0.85* | *0.78-0.93* | 0.85 | 0.56-1.25 | *0.71* | *0.57-0.87* |
| Unknown | - | - | 0.85 | 0.48-1.40 | 1.84 | 0.02-10.21 | 1.12 | 0.36-2.62 |

## Table 9B. Career Management Field and Disability Evaluations.

| CMF | Disability Evaluations, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Chronic | Confidence Interval | Neck Chronic | Confidence Interval |
| General/Executive Officers | - | - | - | - |
| Tactical Operations Officers | 1.14 | 1.02-1.27 | 1.02 | 0.70-1.44 |
| Intelligence Officers | 1.11 | 0.82-1.47 | 1.11 | 0.41- 2.42 |
| Engineering & Maintenance Officers | 1.42 | 1.20-1.67 | 0.95 | 0.49-1.67 |
| Scientists and Professionals | *0.41* | *0.26-0.63* | 0.64 | 0.20-1.48 |
| Health Care Officers | 0.99 | 0.84-1.17 | 1.47 | 0.97-2.12 |
| Administrators | 0.98 | 0.76-1.24 | 0.78 | 0.31-1.60 |
| Supply, Procurement and Allied Officers | 1.13 | 0.89-1.41 | 0.70 | 0.26-1.53 |
| Non-occupational Officers | *0.50* | *0.38-0.65* | 0.93 | 0.47-1.67 |
| Unknown | - | - | - | - |

## Table 9C. Career Management Field and Safety Center Reports.

| CMF | Safety Center Accident Reports, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Acute | Confidence Interval | Neck Acute | Confidence Interval |
| General/Executive Officers | - | - | - | - |
| Tactical Operations Officers | 1.30 | 1.14-1.47 | 1.37 | 1.10-1.67 |
| Intelligence Officers | 0.76 | 0.47-1.17 | 0.44 | 0.12-1.11 |
| Engineering & Maintenance Officers | 0.86 | 0.65-1.12 | 0.98 | 0.61-1.50 |
| Scientists and Professionals | 0.77 | 0.46-1.20 | 0.57 | 0.15-1.46 |
| Health Care Officers | 0.99 | 0.79-1.23 | 0.94 | 0.61-1.39 |
| Administrators | 0.90 | 0.63-1.24 | 0.62 | 0.27-1.23 |
| Supply, Procurement and Allied Officers | 0.96 | 0.69- 1.31 | 1.30 | 0.77-2.06 |
| Non-occupational Officers | *0.67* | *0.50-0.88* | *0.53* | *0.29-0.88* |
| Unknown | - | - | - | - |

## Table 9D. Career Management Field and Outpatient Visits.

| CMF | Outpatient Visits, 1998-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Interval | Back Chronic | Confidence Interval | Neck Acute | Confidence Interval | Neck Chronic | Confidence Interval |
| General/ Executive Officers | 1.16 | 0.87-1.51 | *0.72* | *0.66-0.80* | 0.89 | 0.61- 1.25 | 1.12 | 0.99-1.27 |
| Tactical Operations Officers | *0.83* | *0.79-0.86* | *0.92* | *0.91-0.93* | *0.77* | *0.73-0.81* | *0.91* | *0.89-0.93* |
| Intelligence Officers | 1.15 | 1.06-1.25 | 1.14 | 1.12- 1.17 | 1.27 | 1.15-1.40 | 1.10 | 1.05-1.15 |
| Engineering & Maintenance Officers | 1.21 | 1.14-1.28 | 1.26 | 1.24-1.28 | 1.11 | 1.03- 1.19 | 1.01 | 0.98-1.05 |
| Scientists and Professionals | 0.94 | 0.86- 1.02 | *0.97* | *0.95- 0.99* | 1.07 | 0.98- 1.17 | *0.94* | *0.90-0.98* |
| Health Care Officers | 1.05 | 1.00-1.10 | *0.96* | *0.95-0.98* | 1.23 | 1.17- 1.30 | 1.27 | 1.24-1.31 |
| Administrators | 1.36 | 1.27-1.47 | 1.17 | 1.14- 1.19 | 1.30 | 1.19- 1.42 | 1.14 | 1.09-1.19 |
| Supply, Procurement and Allied Officers | 1.19 | 1.12-1.27 | 1.06 | 1.04- 1.08 | 1.00 | 0.92-1.09 | *0.89* | *0.85-0.93* |
| Non-occupational Officers | *0.75* | *0.70-0.81* | *0.81* | *0.79- 0.83* | *0.75* | *0.68-0.83* | *0.64* | *0.61-0.67* |
| Unknown | 0.90 | 0.60-1.29 | *0.88* | *0.79- 0.97* | 1.19 | 0.80- 1.71 | *0.79* | *0.64-0.96* |

## Table 10 Components. SMRs for Neck and Back Problems, Active Duty Army Enlisted Soldiers.

### Table 10A. Career Management Field and Inpatient Hospitalizations.

| CMF | Inpatient Hospitalizations, 1980-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Intervals | Back Chronic | Confidence Intervals | Neck Acute | Confidence Intervals | Neck Chronic | Confidence Intervals |
| Infantry/Gun Crews | 1.10 | 1.04-1.17 | 1.01 | 0.99- 1.04 | 1.24 | 1.17-1.31 | 1.03 | 0.97-1.09 |
| Electronic Equipment Repair | *0.70* | *0.60-0.83* | *0.86* | *0.82- 0.91* | *0.81* | *0.69-0.94* | 0.98 | 0.86-1.11 |
| Communication and Intelligence | 0.93 | 0.84-1.02 | 0.98 | 0.95-1.02 | 0.99 | 0.90-1.08 | 0.92 | 0.84-1.01 |
| Health Care | 1.32 | 1.19-1.46 | 1.09 | 1.05-1.14 | 0.98 | 0.86- 1.10 | 1.23 | 1.12-1.35 |
| Technical/Allied Specialist | *0.66* | *0.52-0.83* | *0.84* | *0.78-0.90* | *0.70* | *0.55-0.88* | 1.00 | 0.85- 1.17 |
| Support/ Administration | *0.92* | *0.85-1.00* | *0.91* | *0.88-0.93* | *0.75* | *0.68-0.82* | *0.92* | *0.86-0.98* |
| Electrical/ Mechanical Equipment Repair | *0.89* | *0.82-0.97* | 1.09 | 1.06-1.12 | 0.94 | 0.87-1.02 | 1.03 | 0.95-1.11 |
| Craftsworkers | 0.85 | 0.67-1.07 | 1.14 | 1.06-1.22 | 1.16 | 0.95-1.40 | 0.99 | 0.79-1.22 |
| Service/Supply | 1.14 | 1.05-1.24 | 1.06 | 1.03-1.10 | 1.06 | 0.97-1.16 | 1.02 | 0.94-1.12 |
| Non-occupational | 1.20 | 0.77-1.78 | *0.69* | *0.53-0.90* | *0.37* | *0.16-0.73* | 0.29 | 0.03-1.03 |
| Unknown | 1.33 | 0.53-2.74 | 0.82 | 0.54-1.18 | *0.19* | *0.00-1.04* | 0.58 | 0.12-1.70 |

### Table 10B. Career Management Field and Disability Evaluations.

| CMF | Disability Evaluations, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Chronic | Confidence Interval | Neck Chronic | Confidence Interval |
| Infantry/Gun Crews | 1.16 | 1.13-1.20 | 1.29 | 1.17-1.42 |
| Electronic Equipment Repair | 0.95 | 0.89-1.01 | 0.84 | 0.65-1.07 |
| Communication and Intelligence | *0.90* | *0.86-0.94* | *0.78* | *0.65-0.93* |
| Health Care | *0.91* | *0.86-0.96* | *0.77* | *0.61-0.96* |
| Technical/Allied Specialist | *0.79* | *0.72-0.87* | 0.95 | 0.68-1.29 |
| Support/Administration | *0.83* | *0.80-0.86* | *0.81* | *0.70-0.93* |
| Electrical/Mechanical Equipment Repair | 1.08 | 1.04-1.12 | 1.08 | 0.94-1.23 |
| Craftsworkers | 1.24 | 1.13-1.35 | 1.45 | 1.05-1.95 |
| Service/Supply | 1.03 | 0.99-1.07 | 1.02 | 0.87-1.19 |
| Non-occupational | *0.59* | *0.42-0.82* | 0.21 | 0.00-1.17 |
| Unknown | *0.36* | *0.14-0.74* | 0.63 | 0.01-3.51 |

## Table 10C. Career Management Field and Safety Center Accident Reports.

| CMF | Safety Center Accident Reports, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Acute | Confidence Interval | Neck Acute | Confidence Interval |
| Infantry/Gun Crews | 1.30 | 1.25-1.36 | 1.11 | 1.04-1.18 |
| Electronic Equipment Repair | *0.79* | *0.70-0.88* | *0.73* | *0.61- 0.87* |
| Communication and Intelligence | *0.86* | *0.79-0.92* | 0.91 | 0.82- 1.01 |
| Health Care | 0.96 | 0.87-1.05 | *0.81* | *0.70- 0.93* |
| Technical/Allied Specialist | *0.82* | *0.70-0.97* | 0.80 | 0.62-1.01 |
| Support/Administration | *0.65* | *0.61-0.71* | *0.87* | *0.80-0.96* |
| Electrical/Mechanical Equipment Repair | 1.02 | 0.96-1.08 | 0.93 | 0.85-1.02 |
| Craftsworkers | 1.23 | 1.06-1.42 | 1.30 | 1.05-1.58 |
| Service/Supply | 1.09 | 1.01-1.16 | 1.38 | 1.27-1.50 |
| Non-occupational | *0.58* | *0.35-0.91* | *0.31* | *0.10-0.72* |
| Unknown | *0.24* | *0.03-0.85* | - | - |

## Table 10D. Career Management Field and Outpatient Visits.

| CMF | Outpatient Visits, 1998-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Interval | Back Chronic | Confidence Interval | Neck Acute | Confidence Interval | Neck Chronic | Confidence Interval |
| Infantry/Gun Crews | *0.72* | *0.71-0.73* | *0.72* | *0.72-0.73* | *0.69* | *0.67-0.70* | *0.84* | *0.83-0.85* |
| Electronic Equipment Repair | *0.95* | *0.93-0.98* | 1.11 | 1.10-1.12 | 0.97 | 0.93-1.01 | *0.96* | *0.94- 0.98* |
| Communication and Intelligence | *0.86* | *0.84-0.88* | *0.92* | *0.91-0.93* | *0.85* | *0.82- 0.88* | *0.94* | *0.92-0.96* |
| Health Care | 1.29 | 1.26-1.31 | 1.17 | 1.16-1.17 | 1.48 | 1.43-1.52 | 1.37 | 1.35-1.40 |
| Technical/ Allied Specialist | 0.98 | 0.94-1.02 | *0.99* | *0.98-1.00* | 1.06 | 1.00-1.12 | *0.91* | *0.88- 0.94-* |
| Support/ Administration | 1.12 | 1.11-1.14 | 1.15 | 1.15-1.16 | 1.20 | 1.17-1.23 | 1.02 | 1.00-1.03 |
| Electrical/ Mechanical Equipment Repair | 1.10 | 1.08-1.12 | 1.10 | 1.09- 1.10 | 1.01 | 0.98-1.04 | 1.03 | 1.01-1.05 |
| Craftsworkers | 1.24 | 1.18-1.29 | 1.22 | 1.20-1.23 | 1.19 | 1.11-1.27 | 1.23 | 1.18-1.28 |
| Service/Supply | 1.27 | 1.25-1.29 | 1.12 | 1.11-1.12 | 1.16 | 1.13-1.19 | 1.07 | 1.05-1.09 |
| Non-occupational | *0.32* | *0.28-0.36* | *0.74* | *0.72- 0.75* | *0.45* | *0.38-0.53* | *0.75* | *0.68-0.83* |
| Unknown | *0.43* | *0.34-0.55* | *0.48* | *0.45-0.51* | *0.46* | *0.32-0.64* | *0.69* | *0.60-0.79* |

## Table 11 Components. SMRs for Neck and Back Injury, Twelve Largest Army Male Enlisted Military Occupational Specialties.

### Table 11A. Top 12 Male MOS Groups and Inpatient Hospitalizations.

| Top 12 MALE MOS Groups | Inpatient Hospitalizations, 1980-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Intervals | Back Chronic | Confidence Intervals | Neck Acute | Confidence Intervals | Neck Chronic | Confidence Intervals |
| 11B Infantryman | 1.26 | 1.14-1.39 | 1.11 | 1.06-1.15 | 1.46 | 1.33-1.60 | 1.19 | 1.07- 1.32 |
| 13B Canon Crewmember | 1.44 | 1.25-1.65 | 0.98 | 0.91-1.04 | 1.18 | 1.01-1.37 | 0.86 | 0.69-1.06 |
| 95B Military Police | 0.99 | 0.82-1.17 | 1.08 | 1.01-1.15 | 0.94 | 0.78- 1.12 | 1.34 | 1.14-1.56 |
| 63B Light Wheeled Mechanic | 0.93 | 0.76-1.12 | 1.13 | 1.05- 1.20 | 0.91 | 0.75-1.10 | 1.09 | 0.90-1.30 |
| 94B Food Service Specialist | 1.26 | 1.03-1.54 | 1.13 | 1.05-1.22 | 1.14 | 0.91-1.41 | *0.81* | *0.65-1.00* |
| 12B Combat Engineer | 0.98 | 0.78-1.21 | 1.08 | 1.00-1.17 | 1.28 | 1.06-1.54 | 1.24 | 0.99-1.54 |
| 76Y Unit Supply Specialist | 1.51 | 1.24-1.82 | 1.05 | 0.97-1.13 | 1.02 | 0.80-1.29 | 0.91 | 0.73- 1.12 |
| 91A/B Medical Specialist | 1.56 | 1.29- 1.86 | 1.21 | 1.12-1.29 | 1.61 | 1.33-1.92 | 1.37 | 1.16-1.62 |
| 71L Administrative Specialist | 0.93 | 0.72-1.19 | 1.05 | 0.97-1.13 | *0.54* | *0.38-0.75* | *0.77* | *0.62-0.94* |
| 19K Armor Crewman | 0.80 | 0.60- 1.03 | *0.84* | *0.76-0.92* | 0.97 | 0.75-1.22 | 0.68 | 0.50-0.90 |
| 19D Cavalry Scout | 0.77 | 0.58-1.02 | *0.88* | *0.79-0.97* | 0.99 | 0.77-1.26 | 0.88 | 0.64-1.17 |
| 11M Fighting Vehicle Infantryman | *0.50* | *0.34-0.70* | *0.84* | *0.75-0.93* | 1.07 | 0.83- 1.35 | 0.82 | 0.61-1.08 |

### Table 11B. Top 12 Male MOS Groups and Disability Evaluations.

| Top 12 MALE MOS Groups | Disability Evaluations, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Chronic | Confidence Interval | Neck Chronic | Confidence Interval |
| 11B Infantryman | 1.67 | 1.59-1.76 | 1.59 | 1.35-1.86 |
| 13B Canon Crewmember | 1.00 | 0.92-1.08 | 0.92 | 0.65-1.26 |
| 95B Military Police | *0.77* | *0.70- 0.84* | 0.95 | 0.68-1.30 |
| 63B Light Wheeled Mechanic | 0.98 | 0.89-1.07 | 1.05 | 0.75-1.44 |
| 94B Food Service Specialist | *0.64* | *0.56-0.73* | 0.87 | 0.56-1.29 |
| 12B Combat Engineer | 1.17 | 1.06-1.28 | 1.21 | 0.83-1.71 |
| 76Y Unit Supply Specialist | *0.67* | *0.59-0.76* | 1.08 | 0.72-1.55 |
| 91A/B Medical Specialist | 1.05 | 0.94-1.15 | 0.94 | 0.62-1.38 |
| 71L Administrative Specialist | *0.70* | *0.62-0.79* | 1.15 | 0.79-1.61 |
| 19K Armor Crewman | 1.13 | 1.01-1.25 | 1.37 | 0.93-1.93 |
| 19D Cavalry Scout | 1.03 | 0.91-1.16 | 0.94 | 0.57-1.47 |
| 11M Fighting Vehicle Infantryman | *1.46* | *1.32-1.61* | 1.39 | 0.93-2.00 |

## Table 11C. Top 12 Male MOS Groups and Safety Center Accident Reports.

| Top 12 MALE MOS Groups | Safety Center Accident Reports, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Acute | Confidence Interval | Neck Acute | Confidence Interval |
| 11B Infantryman | 1.69 | 1.58-1.80 | 1.18 | 1.05-1.32 |
| 13B Canon Crewmember | 1.07 | 0.94-1.21 | 0.89 | 0.73-1.08 |
| 95B Military Police | 1.28 | 1.13-1.44 | 1.77 | 1.52- 2.04 |
| 63B Light Wheeled Mechanic | *0.82* | *0.70-0.96* | *0.72* | *0.56-0.92* |
| 94B Food Service Specialist | 0.83 | 0.67-1.00 | 0.80 | 0.60-1.06 |
| 12B Combat Engineer | 1.39 | 1.20-1.59 | 1.34 | 1.09-1.64 |
| 76Y Unit Supply Specialist | 0.82 | 0.67-1.01 | 0.91 | 0.68-1.19 |
| 91A/B Medical Specialist | 1.37 | 1.17-1.59 | 1.27 | 1.00-1.58 |
| 71L Administrative Specialist | *0.54* | *0.42- 0.70* | *0.69* | *0.49-0.94* |
| 19K Armor Crewman | 1.22 | 1.03-1.44 | 1.36 | 1.08-1.70 |
| 19D Cavalry Scout | 0.88 | 0.71-1.08 | 1.18 | 0.91-1.51 |
| 11M Fighting Vehicle Infantryman | 0.95 | 0.77-1.15 | 1.48 | 1.17-1.84 |

## Table 11D. Top 12 Male MOS Groups and Outpatient Visits.

| Top 12 MALE MOS Groups | Outpatient Visits, 1998-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Interval | Back Chronic | Confidence Interval | Neck Acute | Confidence Interval | Neck Chronic | Confidence Interval |
| 11B Infantryman | *0.79* | *0.77- 0.82* | *0.70* | *0.70-0.71* | *0.82* | *0.78-0.85* | *0.89* | *0.87-0.92* |
| 13B Canon Crewmember | *0.84* | *0.80-0.89* | *0.85* | *0.84-0.87* | *0.69* | *0.63-0.74* | *0.84* | *0.80-0.88* |
| 95B Military Police | *0.83* | *0.79-0.87* | *0.92* | *0.91-0.94* | *0.83* | *0.77- 0.89* | *0.90* | *0.86-0.94* |
| 63B Light Wheeled Mechanic | 1.20 | 1.15-1.25 | 1.16 | 1.15-1.18 | 0.97 | 0.91- 1.04 | 1.02 | 0.98-1.07 |
| 94B Food Service Specialist | 0.49 | 1.00-1.43 | *0.41* | *0.27-0.59* | - | - | 1.08 | 0.54-1.93 |
| 12B Combat Engineer | *0.89* | *0.85-0.94* | *0.90* | *0.89-0.91* | *0.65* | *0.60-0.71* | *0.88* | *0.84-0.93* |
| 76Y Unit Supply Specialist | - | - | *0.42* | *0.15-0.92* | - | - | 0.66 | 0.07-2.37 |
| 91A/B Medical Specialist | *0.89* | *0.84-0.93* | *0.88* | *0.87-0.90* | 1.02 | 0.95-1.09 | 1.05 | 1.01-1.09 |
| 71L Administrative Specialist | 1.00 | 0.94-1.07 | 1.06 | 1.04-1.08 | 0.95 | 0.86-1.04 | 0.86 | 0.82-0.92 |
| 19K Armor Crewman | *0.61* | *0.58-0.65* | *0.67* | *0.66-0.68* | *0.62* | *0.57-0.68* | *0.82* | *0.79-0.86* |
| 19D Cavalry Scout | *0.69* | *0.64-0.73* | *0.73* | *0.72-0.75* | *0.81* | *0.74-0.89* | *0.91* | *0.86-0.96* |
| 11M Fighting Vehicle Infantryman | *0.47* | *0.44-0.49* | *0.56* | *0.55- 0.57* | *0.45* | *0.41-0.50* | *0.71* | *0.68-0.74* |

## Table 12 Components. SMRs for Neck and Back Injury, Twelve Largest Army Female Enlisted Military Occupational Specialties.

### Table 12A. Top Female MOS Groups and Inpatient Hospitalizations.

| Top 12 FEMALE MOS Groups | Inpatient Hospitalizations, 1980-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Intervals | Back Chronic | Confidence Intervals | Neck Acute | Confidence Intervals | Neck Chronic | Confidence Intervals |
| 71L Administrative Specialist | *0.72* | *0.51-0.99* | *0.82* | *0.73-0.91* | *0.64* | *0.44-0.90* | *0.71* | *0.50-0.97* |
| 91A/B Medical Specialist | 1.61 | 1.19-2.13 | 1.03 | 0.89-1.18 | 1.08 | 0.75- 1.51 | 1.18 | 0.78-1.72 |
| 76Y Unit Supply Specialist | 1.59 | 1.03-2.35 | 1.10 | 0.90-1.32 | 0.75 | 0.39-1.31 | 0.51 | 0.19-1.11 |
| 94B Food Service Specialist | 1.52 | 0.98-2.27 | 1.07 | 0.88-1.29 | 1.11 | 0.66-1.76 | 0.68 | 0.29-1.34 |
| 95B Military Police | 0.78 | 0.42-1.34 | 1.32 | 1.10-1.57 | 0.85 | 0.48- 1.41 | 1.90 | 1.15- 2.97 |
| 75B Personnel Administration | 1.26 | 0.65-2.20 | *0.74* | *0.54-0.99* | 0.93 | 0.42-1.77 | 0.95 | 0.38-1.97 |
| 91C Licensed Practical Nurse | 3.19 | 2.10-4.65 | 1.90 | 1.63-2.20 | 1.65 | 0.85-2.87 | 0.74 | 0.38-1.29 |
| 63B Light Wheeled Mechanic | 1.26 | 0.63-2.26 | 1.02 | 0.77-1.33 | 1.22 | 0.61-2.18 | 0.65 | 0.17-1.66 |
| 88M Motor Transport Operator | 0.59 | 0.22-1.28 | *0.76* | *0.57-0.99* | 0.78 | 0.33-1.53 | 0.81 | 0.33-1.68 |
| 92A Automated Logistics Specialist | *0.39* | *0.13-0.91* | *0.58* | *0.44-0.76* | 0.47 | 0.17-1.01 | 1.32 | 0.76-2.15 |
| 92Y Unit Supply Specialist | *0.10* | *0.00-0.53* | *0.38* | *0.26-0.54* | *0.30* | *0.06-0.86* | 0.78 | 0.37-1.44 |
| 77F Petroleum Supply Specialist | 1.52 | 0.81- 2.60 | 0.82 | 0.59-1.10 | 1.13 | 0.54-2.07 | 0.51 | 0.10-1.49 |

### Table 12B. Top Female MOS Groups and Disability Evaluations.

| Top 12 FEMALE MOS Groups | Disability Evaluations, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Chronic | Confidence Interval | Neck Chronic | Confidence Interval |
| 71L Administrative Specialist | *0.77* | *0.67- 0.90* | 0.98 | 0.57-1.57 |
| 91A/B Medical Specialist | 1.28 | 1.09-1.50 | 0.65 | 0.24-1.41 |
| 76Y Unit Supply Specialist | *0.46* | *0.31- 0.65* | 0.41 | 0.05-1.47 |
| 94B Food Service Specialist | 0.79 | 0.59-1.03 | 0.61 | 0.12-1.79 |
| 95B Military Police | 1.84 | 1.52- 2.20 | 1.26 | 0.46-2.75 |
| 75B Personnel Administration | 1.39 | 1.06-1.80 | 1.65 | 0.53-3.84 |
| 91C Licensed Practical Nurse | 1.30 | 0.99-1.67 | 1.91 | 0.76-3.93 |
| 63B Light Wheeled Mechanic | 2.11 | 1.67-2.64 | 1.89 | 0.61-4.40 |
| 88M Motor Transport Operator | 2.37 | 1.93-2.87 | 1.24 | 0.33-3.17 |
| 92A Automated Logistics Specialist | 2.32 | 1.94-2.75 | 1.19 | 0.38- 2.78 |
| 92Y Unit Supply Specialist | 1.95 | 1.57-2.39 | 1.37 | 0.44- 3.19 |
| 77F Petroleum Supply Specialist | 2.45 | 1.96-3.02 | 0.77 | 0.09-2.79 |

## Table 12C. Top Female MOS Groups and Safety Center Accident Reports.

| Top 12 FEMALE MOS Groups | Safety Center Accident Reports, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Acute | Confidence Interval | Neck Acute | Confidence Interval |
| 71L Administrative Specialist | *0.59* | *0.44-0.78* | 0.81 | 0.56- 1.13 |
| 91A/B Medical Specialist | 0.94 | 0.69-1.25 | 0.96 | 0.61-1.42 |
| 76Y Unit Supply Specialist | 0.70 | 0.41-1.10 | 0.92 | 0.48-1.61 |
| 94B Food Service Specialist | *0.58* | *0.32-0.95* | 1.15 | 0.64-1.89 |
| 95B Military Police | 1.49 | 1.07-2.02 | 2.61 | 1.83-3.61 |
| 75B Personnel Administration | *0.32* | *0.10-0.74* | 1.01 | 0.43-1.99 |
| 91C Licensed Practical Nurse | 1.44 | 0.87-2.25 | 1.07 | 0.43-2.21 |
| 63B Light Wheeled Mechanic | 1.25 | 0.74-1.98 | 1.52 | 0.76-2.72 |
| 88M Motor Transport Operator | 1.26 | 0.78-1.93 | 1.20 | 0.57-2.20 |
| 92A Automated Logistics Specialist | 0.76 | 0.44-1.24 | 1.53 | 0.87-2.48 |
| 92Y Unit Supply Specialist | 0.71 | 0.37-1.25 | 1.20 | 0.57-2.20 |
| 77F Petroleum Supply Specialist | 1.35 | 0.81- 2.10 | 1.41 | 0.67-2.59 |

## Table 12D. Top Female MOS Groups and Outpatient Visits.

| Top 12 FEMALE MOS Groups | Outpatient Visits, 1998-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Interval | Back Chronic | Confidence Interval | Neck Acute | Confidence Interval | Neck Chronic | Confidence Interval |
| 71L Administrative Specialist | 1.49 | 1.41-1.57 | 1.49 | 1.47-1.51 | 1.79 | 1.66-1.91 | 1.58 | 1.51-1.64 |
| 91A/B Medical Specialist | 1.49 | 1.41-1.58 | 1.43 | 1.41-1.46 | 2.11 | 1.96-2.27 | 2.24 | 2.14-2.35 |
| 76Y Unit Supply Specialist | - | - | - | - | - | - | - | - |
| 94B Food Service Specialist | 1.56 | 0.17-5.62 | 0.97 | 0.51-1.65 | 3.36 | 0.38-12.13 | 4.76 | 2.17-9.03 |
| 95B Military Police | 1.68 | 1.56- 1.82 | 1.83 | 1.79-1.87 | 1.79 | 1.59-2.01 | 2.01 | 1.87-2.16 |
| 75B Personnel Administration | 1.67 | 1.51- 1.84 | 1.78 | 1.73- 1.84 | 1.61 | 1.37-1.88 | 1.08 | 0.95-1.23 |
| 91C Licensed Practical Nurse | 1.89 | 1.68-2.11 | 1.69 | 1.63-1.75 | 3.11 | 2.74-3.53 | 2.20 | 2.03-2.37 |
| 63B Light Wheeled Mechanic | 2.08 | 1.88-2.30 | 1.90 | 1.84-1.96 | 1.83 | 1.55-2.14 | 1.88 | 1.71-2.08 |
| 88M Motor Transport Operator | 2.29 | 2.15-2.43 | 1.84 | 1.80-1.89 | 2.11 | 1.91-2.33 | 1.98 | 1.86-2.11 |
| 92A Automated Logistics Specialist | 1.57 | 1.49-1.65 | 1.73 | 1.70-1.76 | 1.83 | 1.70-1.96 | 1.63 | 1.55-1.71 |
| 92Y Unit Supply Specialist | 1.56 | 1.48-1.65 | 1.66 | 1.63-1.68 | 1.87 | 1.72-2.02 | 1.84 | 1.76-1.93 |
| 77F Petroleum Supply Specialist | 1.67 | 1.54-1.80 | 1.82 | 1.78-1.86 | 1.55 | 1.37-1.76 | 1.67 | 1.54-1.81 |

## Table 13 Components. Hazardous Duty Pay and SMR for Army Officers by Health Outcome.

### Table 13A. Hazardous Duty Pay (Officers) and Inpatient Hospitalizations.

| HAZARDOUS DUTY PAY – For Officers | Inpatient Hospitalizations, 1980-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Intervals | Back Chronic | Confidence Intervals | Neck Acute | Confidence Intervals | Neck Chronic | Confidence Intervals |
| Parachute Pay | *0.65* | *0.42-0.95* | *0.71* | *0.65-0.77* | 1.08 | 0.75-1.50 | 0.93 | 0.78-1.10 |
| Flight Pay | 0.61 | 0.26-1.20 | 1.25 | 1.11-1.39 | 0.51 | 0.16-1.18 | 1.46 | 1.17-1.81 |
| Parachute and Flight Pay | 0.39 | 0.01-2.15 | 0.97 | 0.71-1.30 | 1.00 | 0.11- 3.59 | 1.49 | 0.81-2.50 |
| Demolition Pay | - | - | 0.58 | 0.30-1.01 | - | - | 1.89 | 0.81-3.72 |
| Top 10th percentile | *0.25* | *0.05-0.72* | *0.87* | *0.75-0.99* | 0.69 | 0.25-1.51 | 1.06 | 0.80-1.38 |
| Top 20th percentile | *0.39* | *0.17-0.78* | *0.86* | *0.77-0.95* | 0.88 | 0.47-1.50 | 1.19 | 0.97-1.45 |

### Table 13B. Hazardous Duty Pay (Officers) and Disability Evaluations.

| HAZARDOUS DUTY PAY – For Officers | Disability Evaluations, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Chronic | Confidence Interval | Neck Chronic | Confidence Interval |
| Parachute Pay | *0.79* | *0.64-0.97* | *0.22* | *0.05-0.66* |
| Flight Pay | 1.49 | 1.14-1.92 | 1.85 | 0.84-3.51 |
| Parachute and Flight Pay | 1.04 | 0.45-2.04 | 1.16 | 0.02-6.47 |
| Demolition Pay | 0.88 | 0.18-2.58 | - | - |
| Top 10th percentile | 0.82 | 0.55-1.17 | 0.68 | 0.14-2.00 |
| Top 20th percentile | 0.96 | 0.73-1.24 | 0.82 | 0.30-1.79 |

### Table 13C. Hazardous Duty Pay (Officers) and Safety Center Accident Reports.

| HAZARDOUS DUTY PAY – For Officers | Safety Center Accident Reports, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Acute | Confidence Interval | Neck Acute | Confidence Interval |
| Parachute Pay | 1.55 | 1.29-1.84 | 1.16 | 0.80-1.63 |
| Flight Pay | 1.94 | 1.43-2.57 | 1.55 | 0.83-2.65 |
| Parachute and Flight Pay | 2.84 | 1.59-4.68 | 1.66 | 0.33-4.86 |
| Demolition Pay | 0.43 | 0.01-2.38 | - | - |
| Top 10th percentile | 2.27 | 1.70-2.98 | 1.72 | 0.92-2.94 |
| Top 20th percentile | 2.08 | 1.65-2.5 | 1.39 | 0.82-2.19 |

## Table 13D. Hazardous Duty Pay (Officers) and Outpatient Visits.

| HAZARDOUS DUTY PAY – For Officers | Outpatient Visits, 1998-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Interval | Back Chronic | Confidence Interval | Neck Acute | Confidence Interval | Neck Chronic | Confidence Interval |
| Parachute Pay | *0.89* | *0.84-0.95* | *0.84* | *0.83-0.86* | *0.87* | *0.81-0.93* | *0.96* | *0.93-1.00* |
| Flight Pay | *0.89* | *0.82-0.97* | 1.25 | 1.23-1.28 | 0.94 | 0.85-1.04 | 1.07 | 1.02-1.12 |
| Parachute and Flight Pay | *0.59* | *0.42-0.80* | *0.51* | *0.46-0.56* | 0.84 | 0.59-1.16 | 0.94 | 0.81-1.10 |
| Demolition Pay | 1.93 | 1.48-2.47 | 1.21 | 1.10-1.33 | 1.60 | 1.12-2.23 | 1.61 | 1.35-1.90 |
| Top 10th percentile | *0.77* | *0.68-0.86* | 0.98 | 0.95-1.01 | 0.94 | 0.82-1.06 | 1.06 | 1.01-1.12 |
| Top 20th percentile | *0.86* | *0.78-0.94* | 1.01 | 0.99-1.04 | 0.90 | 0.81-1.00 | 0.99 | 0.95-1.04 |

## Table 14 Components. Hazardous Duty Pay and SMR for Enlisted Soldiers by Health Outcome.

### Table 14A. Hazardous Duty Pay (Enlisted) and Inpatient Hospitalizations.

| HAZARDOUS DUTY PAY – For Enlisted | Inpatient Hospitalizations, 1980-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Intervals | Back Chronic | Confidence Intervals | Neck Acute | Confidence Intervals | Neck Chronic | Confidence Intervals |
| Parachute Pay | *0.67* | *0.59-0.77* | *0.84* | *0.80- 0.87* | 1.03 | 0.92-1.15 | 1.30 | 1.19-1.42 |
| Flight Pay | *0.71* | *0.50-0.96* | 0.93 | 0.85- 1.02 | *0.61* | *0.41- 0.86* | 1.27 | 1.04-1.54 |
| Parachute and Flight Pay | 0.72 | 0.33-1.37 | 0.98 | 0.80-1.18 | 0.51 | 0.19 1.11 | 1.26 | 0.77-1.94 |
| Demolition Pay | 0.55 | 0.22-1.14 | *0.70* | *0.56- 0.87* | *1.02* | *0.52- 1.78* | 1.77 | 1.21-2.50 |
| Top 10th percentile | *0.55* | *0.40-0.74* | *0.62* | *0.57-0.68* | *0.75* | *0.56-0.98* | 1.10 | 0.93-1.28 |
| Top 20th percentile | *0.59* | *0.47-0.73* | *0.66* | *0.62-0.70* | *0.76* | *0.61-0.92* | 1.22 | 1.08-1.37 |

### Table 14B. Hazardous Duty Pay (Enlisted) and Disability Evaluations.

| HAZARDOUS DUTY PAY – For Enlisted | Disability Evaluations, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Chronic | Confidence Interval | Neck Chronic | Confidence Interval |
| Parachute Pay | 1.06 | 1.01-1.12 | 1.21 | 1.02- 1.43 |
| Flight Pay | *0.63* | *0.54-0.73* | 0.60 | 0.32-1.03 |
| Parachute and Flight Pay | *0.50* | *0.34-0.71* | 1.08 | 0.35-2.52 |
| Demolition Pay | *0.51* | *0.35-0.72* | 0.41 | 0.05-1.49 |
| Top 10th percentile | *0.32* | *0.27-0.37* | *0.39* | *0.21-0.66* |
| Top 20th percentile | *0.47* | *0.42-0.52* | *0.72* | *0.52-0.97* |

### Table 14C. Hazardous Duty Pay (Enlisted) and Safety Center Accident Reports.

| HAZARDOUS DUTY PAY – For Enlisted | Safety Center Accident Reports, 1980-2002 | | | |
|---|---|---|---|---|
| | Back Acute | Confidence Interval | Neck Acute | Confidence Interval |
| Parachute Pay | 1.73 | 1.62-1.84 | 1.09 | 0.97-1.22 |
| Flight Pay | 1.23 | 1.01-1.49 | 1.02 | 0.75-1.37 |
| Parachute and Flight Pay | 1.70 | 1.18-2.37 | 1.19 | 0.62-2.08 |
| Demolition Pay | 0.94 | 0.56-1.46 | 1.29 | 0.68-2.20 |
| Top 10th percentile | 1.69 | 1.47-1.93 | 0.93 | 0.71-1.21 |
| Top 20th percentile | 1.59 | 1.43-1.76 | 0.97 | 0.79-1.16 |

## Table 14D. Hazardous Duty Pay (Enlisted) and Outpatient Visits.

| HAZARDOUS DUTY PAY – For Enlisted | Outpatient Visits, 1998-2002 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Back Acute | Confidence Interval | Back Chronic | Confidence Interval | Neck Acute | Confidence Interval | Neck Chronic | Confidence Interval |
| Parachute Pay | *0.88* | *0.86-0.90* | *0.72* | *0.71-0.72* | 1.11 | 1.08-1.14 | *0.95* | *0.93-0.97* |
| Flight Pay | *0.75* | *0.70-0.81* | *0.71* | *0.69- 0.72* | 0.97 | 0.88-1.06 | *0.93* | *0.88-0.98* |
| Parachute and Flight Pay | *0.76* | *0.65-0.90* | *0.54* | *0.51- 0.58* | 0.88 | 0.69-1.10 | *0.50* | *0.41-0.60* |
| Demolition Pay | *0.75* | *0.67-0.84* | *0.75* | *0.73- 0.78* | *0.80* | *0.68-0.94* | 0.92 | 0.85-1.01 |
| Top 10th percentile | *0.63* | *0.59-0.68* | *0.48* | *0.47-0.49* | *0.67* | *0.60-0.74* | *0.66* | *0.63- 0.70* |
| Top 20th percentile | *0.71* | *0.68-0.74* | *0.56* | *0.55-0.56* | *0.84* | *0.79-0.90* | *0.72* | *0.70-0.75* |